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VOL. LXX. No. 1

THE FOSSIL ANTS OF NORTH AMERICA

BY F. M. CARPENTER

WITH ELEVEN PLATES.

CAMBRIDGE, MASS., U. S. A.:
PRINTED FOR THE MUSEUM
JANUARY, 1930

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No. 1.— *The Fossil Ants of North America*[1]

By F. M. Carpenter

I. Introduction

Sixty-three years ago, when the first fossil insects were discovered in American Tertiary rocks, a new era began in the study of the geological history of the insects. Early expeditions under the stimulating leadership of Dr. S. H. Scudder, with the coöperation of the United States Geological Surveys, secured collections of over 20,000 specimens in the Florissant shales alone. For the most part, the material gathered at this time was described by Scudder between the years 1867 and 1900, when he was finally forced into inactivity by paralysis. For a short period of five years the Tertiary insects of the country were entirely neglected, but in 1905 the work was again taken up by the University of Colorado. The following year Professor W. M. Wheeler, Professor and Mrs. T. D. A. Cockerell, and S. A. Rohwer collected extensively at the Florissant locality, and in 1907 also a large expedition was made to the same beds under the direction of the American Museum of Natural History, Yale University, the University of Colorado, the British Museum of Natural History, and the Royal Irish Dublin Museum. The insects found on these two expeditions have chiefly been described by Professor Cockerell, Professor H. F. Wickham (Coleoptera), Professor C. T. Brues (Parasitic Hymenoptera), and S. A. Rohwer (Tenthredinoidea).

The long illness which Scudder endured after 1900, and which finally caused his death ten years later, prevented him from completing the investigations on the Florissant insects, so that when his collection was donated to the Museum of Comparative Zoölogy in 1902, fully half of the specimens were unstudied. This unworked material was found by Professor Wheeler to include over 4,000 ants which, together with as many more obtained on the later expeditions, were turned over to him for study. At about that time Professor Wheeler was occupied with the preparation of a monograph of the ants of the Baltic amber and after he had finished this task, he was prevented by other matters from carrying out his intention of describing the Florissant ant fauna. In 1925, at the suggestion of Dr. Wheeler, I undertook the study of these

[1] Contribution from the Entomological Laboratory of the Bussey Institution, No. 307. Studies aided by an Anna C. Ames Memorial Fellowship and a Sheldon Traveling Fellowship.

fossils, and have since been able to increase the collection to about 12,000 specimens, and to include ants from other American insect deposits. Some of this additional material was collected by the writer at Florissant, Colorado, and Green River, Wyoming, during the summer of 1927, but for the most part it has been received from the following sources: the United States National Museum, Washington, D. C.; Princeton University, Princeton, N. J.; the Carnegie Museum, Pittsburgh, Pa.; the Museum of Comparative Zoölogy, Cambridge, Mass.; Professor T. D. A. Cockerell, University of Colorado, Boulder, Colorado; Professor H. F. Wickham, University of Iowa, Iowa City, Iowa; Mr. Earl Douglass, Salt Lake City, Utah; and Professor J. H. Johnson, Colorado School of Mines, Golden, Colorado. To these contributors, as well as those mentioned before, I am greatly indebted for the use of their material.

For the privilege of examining and photographing the types of previously described fossil ants, I am especially indebted to Dr. E. M. Kindle, Canadian Geological Survey, Ottawa, Canada; Professor T. D. A. Cockerell, University of Colorado, Boulder, Colorado; Dr. R. S. Bassler, United States National Museum, Washington, D. C.; and Professor Nathan Banks, Museum of Comparative Zoölogy, Cambridge, Mass.

In designating the holotypes of the new species an attempt has been made to select the individuals showing most of the necessary characters, and since the Scudder collection includes much better material than the others, the majority of the holotypes are in the Museum of Comparative Zoölogy. Only one of the specimens secured on the 1907 expedition of the several museums mentioned above has been selected as a holotype, and at the suggestion of Professor Cockerell, who was in charge of the expedition, this has been placed in the same institution in order to keep as many of the holotypes together as possible. Professor Wickham has kindly donated the holotypes in his collection to the Museum of Comparative Zoölogy. Paratypes of the Florissant species have been allotted to the contributing institutions, so that the museums and universities listed above have as nearly a complete series of these ants as the number of duplicates has allowed.

To Professor W. M. Wheeler I am more than grateful for the suggestion of an investigation which has proved so interesting; for the use of his splendid collection of recent ants; and above all for the generous amount of time which he has spent with me discussing the fossils and their affinities. Indeed, without Professor Wheeler's assistance this task would never have been satisfactorily completed. Professor Brues

has also made many helpful suggestions and I am especially appreciative of his interest and encouragement, which has attended the work throughout.

Very little study has previously been made on the fossil ants of American deposits. Scudder described (1877a, 1878) four supposed ants from the Green River formation, and five others (1877b) from the Quesnel beds in British Columbia. Cockerell, more recently (1906, 1927), has described three species from Florissant, two from the Green River shales (1921, 1923b), and one from a small deposit in Brazos County, Texas (1923a). Professor Wheeler has briefly referred to these fossils in his general works on ants (1910, 1926, 1928), and in his study of the mountain ants of western North America (1917) has listed the genera of Florissant which he recognized by a cursory examination of the material at his disposal.

As a result of this neglect of the American forms, our knowledge of the geological history of the ants has been based almost exclusively upon the fossils found in the Tertiary formations of Europe, of which the most important is the Baltic amber (Oligocene). The ants contained in this resin belong to ninety-two species, referred by Mayr (1867) and Wheeler (1914) to the following genera: *Prionomyrmex,* Bradoponera,* Ectatomma, Electroponera,* Platythyrea, Euponera, Ponera, Sima, Monomorium, Erebomyrma, Vollenhovia, Stenamma, Aphaenogaster, Electromyrmex* Agroecomyrmex,* Myrmica, Nothomyrmica,* Leptothorax, Stiphromyrmex,* Ennearcrus,* Protaneuretus,* Paraneuretus,* Dolichoderus, Iridomyrmex, Liometopum, Asymphylomyrmex,* Pityomyrmex,* Plagiolepis, Rhopalomyrmex,* Dimorphomyrmex,*[1] *Gesomyrmex, Prodimorphomyrmex,* Oecophylla, Prenolepis, Lasius, Formica, Glaphyromyrmex,* Pseudolasius, Dryomyrmex,** and *Camponotus.* The Formicidae of the much rarer Sicilian amber were studied by Professor Carlo Emery (1891, 1913), who recognized the following genera: *Ectatomma, Ponera* (*?*), *Cataulacus, Hypomyrmex,* Podomyrmex,* Aëromyrma, Meranoplus, Leptothorax, Tapinoma, Technomyrmex, Plagiolepis, Gesomyrmex,* and *Oecophylla.* The two most productive of the Tertiary rock deposits of Europe, as far as insects are concerned, are at Radoboj in Croatia, and Oeningen in Baden. The ants of the Radoboj formation were described by Heer before our present conception of the genera of ants had been reached, so that the species were lumped into *Formica, Myrmica, Ponera,* and *Attopsis.* Fortunately, Mayr was able to examine a number of speci-

* Extinct.

[1] Recently shown by Wheeler to be synonymous with *Gesomyrmex* (Psyche, **36**, p. 1–12, 1929).

mens determined by Heer, and to correct the generic determinations (1867). He considered that the following genera were represented: *Tetramorium* (?), *Prenolepis* (?), *Aphaenogaster*, *Myrmica* (?), *Cataulacus*, *Leptothorax* (?), *Dolichoderus*, *Liometopum*, *Lonchomyrmex*,* *Plagiolepis*, *Oecophylla*, *Lasius*, *Formica*, and *Camponotus*. The Oeningen ants were described by Heer also, at the same time, but since no myrmecologist has revised his determinations, we are obliged to disregard these ants at present.

Two deposits in the British Isles have yielded a few members of this family. From the older of these, the Bagshot beds of Bournemouth (Eocene), Cockerell has described (1920) two species, but since only the wings are preserved, the generic determinations are very dubious. The second deposit is at Gurnet Bay, Isle of Wight, and belongs to the Oligocene period. A few ants from there were first described by Cockerell (1915), and these were later revised and added to by H. St. J. K. Donisthorpe, the well-known British myrmecologist, who was able to examine a large series of these fossils (1920). The genera recognized by Donisthorpe include *Syntaphus*,* *Euponera*, *Ponera*, *Emplastus*,* *Dolichoderus*, *Leucotaphus*,* *Oecophylla*, and *Camponotus*. The ants of the other European deposits have not been sufficiently well treated to warrant their mention in this paper.

The study of fossil insects, with the exception of most of those imbedded in amber, is beset with many difficulties which make progress exceedingly slow, and which at times are responsible for no little discouragement. These obstacles are the direct result of the flattened condition of the insects, caused by the pressure of the strata above that containing the specimens. As the weight of these strata increases with the accumulation of sediment, the insects are pressed almost into a single plane. The disadvantage of this is obvious, for when the systematic position of a living insect is to be determined, the specimen must usually be examined in various positions and attitudes in order to reveal all the necessary characters. But since the fossil insect can be seen in just one position, only those characters visible in this position can be determined. The shape of the head, for example, can be used as a descriptive character only when the fossil shows a dorsal aspect. In the case of the ants this flattening is especially disconcerting, because the dorsal aspect of the head and a lateral view of the pedicel are nearly essential for the determination of the affinities of a species. Fortunately, there are a few structures, such as antennae and wings, which are visible in any attitude and are consequently the principle means of correlating the specimens in various positions.

* Extinct.

There are two types of distortions of the ants also resulting from flattening. The most obvious of these is the increase in the width of the specimen which takes place as the latter is pressed flat. The effect of this, of course, is to give the insect a more robust appearance than was characteristic of the ant when alive. Apparently the intensity of this pressure was very great, for the chitin of the head of many specimens is distinctly cracked just in front of the posterior angles, as in the holotype specimen of *Formica cockerelli*, sp. nov. (Plate 4, fig. 3). This splitting of the chitin occurs in precisely the same place, if a recent ant is pressed flat, and since it is always followed by a collapse of the entire head, which consequently becomes much broader, the presence or absence of the splitting indicates the degree of flattening which has taken place and provides a means of determining the original shape of the head. The second type of distortion is less evident, but equally noteworthy. It will be observed in most of the photographs of the Florissant species that the eyes are more remote from the lateral margins of the head than they are in the majority of living species. This is not a morphological peculiarity of the extinct species, but is merely due to the flattening of the head, and can be duplicated in recent forms by applying the necessary amount of pressure.

The application of a dilute solution of damar to the fossil has been found to improve the visibility of the insects nearly a hundred per cent. Many structures, especially the antennal segments and the veins of the wing, which could not otherwise be discerned in some specimens, become very distinct by the use of this medium. The resin hardens in a few hours, thus serving to protect the fossil from dust or scratches, and even from the cracking caused by the changes of atmospheric conditions. The hardened damar can easily be removed if desired, by soaking the specimen in xylol for a few days and then washing it for an equivalent time in absolute alcohol.

The Florissant ants are the only ones from American deposits which are sufficiently well preserved to permit determination of the generic affinities. Even the Green River shales, which have yielded a great number of splendidly preserved insects of other groups, have not produced a single satisfactory ant. My observations of the European fossil ants lead me to the conclusion also that those of Florissant are far better preserved than those of any other known deposit, excepting, of course, the Baltic amber. I have never seen a Radoboj or Oeningen ant with the eyes, antennae, or clypeus preserved, and very few of those described by Heer from those two localities show such details, as do the many of the Florissant specimens.

Only a small percentage of the ants in the collections at my disposal consist of both obverse and reverse. This is rather unfortunate, since the reverse is never the mirror image of the obverse. If, for example, a specimen is preserved in a dorso-lateral position, one half shows the structures as seen from above (eyes, clypeus, etc.) and the counterpart, only those visible from beneath (maxillae, etc.). This condition is well illustrated by the holotype of *Archiponera wheeleri*, sp. nov., of which the obverse is shown on Plate 1 and the reverse on Plate 2, fig. 1. When, however, the ant has been excessively crushed, as has frequently happened, the structures on the dorsal surface of the body may be faintly impressed on the ventral half. Of course, there are no structural differences in the halves of a fossil showing a lateral view of the ant, since the latter is bilaterally symmetrical.

Although the classification of living ants is based largely on workers, the poor representation of this caste among the fossils prevents us from following the same procedure in this study. As a consequence, I have substituted wherever possible the female for the worker as the important form of the species. The nature of the preservation of the ants has also required the selection of taxonomic characters somewhat different from those usually employed in the study of recent ants. The venation of the forewing is nearly indispensable for classification of the fossils, and inasmuch as the commonest castes are males and females, most of the specimens are winged. It is very essential, however, that venational characters be used with considerable caution, for in the ants as a whole the nature of the venation seems to be of little phylogenic value. The arrangement of the veins in some of the highly specialized myrmicines, for example, is identical with that of certain primitive ponerines, yet the venation of two species within the same genus may be utterly different. Many ants, as *Lasius umbratus* (Adolf, 1880), have an exceedingly variable venation, and only a very few species, if any, have the shape of the cubital and discoidal cells exactly constant. It is not practical, therefore, to base a species on the micro-measurements of the sides of a cell, as Cockerell has done in his description of three ants from Florissant and a number of others from European deposits. There are some genera, however, which have the arrangement of the veins fairly constant and many of these are made distinctive by certain peculiarities which prove a great help in recognizing the genus — e.g., in *Myrmica* the apical half of the first intercubitus is always lacking. As far as the Florissant ants are concerned, the venation affords the best means of distinguishing the dolichoderines from the formicines, for the character ordinarily used to separate these

subfamilies, the shape of the cloaca, cannot be seen in the fossils. Venational studies have shown that if a member of one of these groups has two cubital cells, it is a dolichoderine; if it has only one cubital cell, it may belong to either subfamily.

The shape of the head, although somewhat distorted in most of the fossil ants, can nevertheless be used as a dependable character. In a large series of specimens of one species at least a few individuals are only very slightly flattened or distorted, and, even if all the specimens of a species are somewhat distorted, it is possible, as indicated above, to obtain a fairly accurate conception of the shape of the head. The mandibles are preserved in most of the Florissant specimens, often with sufficient completeness to show the details of the dentition. The clypeus is occasionally, but not frequently, visible at least to such an extent that the contour of the posterior margin can be determined. The antennae furnish the most reliable characters and this is especially advantageous because the same structure is likewise used in the classification of recent forms. The value of antennal characters in the fossils is also dependent upon the fact that the antennae are only a very little, if at all, distorted by the pressure which flattens the body of the insects. The length of the scape and the relative size of the funicular segments have been determined for nearly all of the Florissant ants, the only exceptions being a few aberrant forms which deserve description because of certain peculiarities. The eyes and even the ocelli have been discerned in most of the species, but it has already been explained above that the position of the eyes with respect to the lateral margins of the head is more or less dependent upon the amount of pressure to which the ant has been subjected. The color of the ants of the Florissant deposit does not usually indicate the original color of the insects and is of little use in identifying the fossil species. Brues has observed (1910) that the metallic colors of the parasitic Hymenoptera were clearly preserved in the Florissant specimens, but the pigmental colors of the ants appear to have been affected by the chemical activity which took place during the process of preservation of these insects. Individuals of a species vary from light brown to black, depending at least partly upon the rapidity of entombment, for the lighter specimens are usually much better preserved than the darker ones. There are, however, a few species, such as *Lasius peritulus* (Ckll.) and *Formica robusta,* n. sp., which are always brown, and since I have found this to be true for the hundreds of individuals of these two species which I have examined, it is very probable that the living ant was this same color. The relative size and qualitative dimensions of the

various parts of the ants are a necessary addition to the specific descriptions, and in the case of some males and a few workers, it has not been possible to give any other specific characters. Unless otherwise noted, the dimension given is the average of the results obtained from measurements of all the individuals of a species; only when a species has been found to be unusually variable are the two extremes indicated.

With some exceptions, each description of a new species is accompanied by a photograph of the holotype and a diagrammatic drawing of the ant. The photographs are essential to show the habitus of the fossils and will be of much assistance in the determination of material, although few details are visible in photographs of the size used. The drawings are not based upon any one specimen, except in the case of uniques, but are composite pictures containing all the characters which have been found in the specimens of the species illustrated. They are not, however, reconstructions in the usual sense of the term. The legs have been omitted from the figures, since they are not ordinarily well enough preserved for taxonomic purposes.

The preceding discussion has been made rather detailed in order to explain some of the problems encountered in this study, and the methods by which they have been partly, at least, overcome. This was considered advisable because the average entomologist appears to be skeptical of the results obtained by the study of fossil insects. The specialist who has for many years been determining his species by the distribution of hairs on the insect's head or the structure of the genitals naturally doubts the systematic value of the gross characters which are alone visible in the fossils, and consequently hesitates to accept the conclusions of the palaeoentomologist. Those who hold such an opinion have, I believe, overlooked the very significant fact that the study of fossil insects is essentially a division of palaeontology, rather than entomology. The palaeoentomologist is primarily concerned with the phylogeny of the insects, and whether or not one of the extinct forms has a little more pubescence on the abdomen than another is of very little consequence. If I have included under the name of *Formica robusta* two closely related species, differing only by the intensity of sculpturing on the clypeus, our conception of the geological history of the ants remains unchanged. The important fact is that the genus *Formica*, or even that a Formica-like genus, existed in Colorado during the Miocene.

The reconstruction of prehistoric life is always a slow process, whether we are concerned with the minute insect or the gigantic dinosaur. The picture of the earth's past is necessarily formed by the grad-

ual accumulation of fragments which, when placed together, make the whole. Just as the extinct reptile, at first known only by a single bone, is finally completely recognized by the addition of further material, so the fossil insect, originally represented by a wing or parts of the body, eventually becomes known to us in all details. And although the accumulation of the necessary specimens may be delayed for many years and the important details missing for an equivalent time, the results, on the whole, are dependable.

II. North American Ant Deposits

Fossil ants have been found in five American localities:[1] the Green River formation of Colorado, Wyoming, and Utah; the Florissant shales of Colorado; the Elko oil shales of Nevada; the Quesnel clays of British Columbia; and the Fayette sandstone of Texas. The oldest of these, and in fact the oldest known ant deposit, is the Green River formation. This deposit has been known to be fossiliferous since the middle of the last century when John Evans collected a small fish in the beds near Green River, Wyoming. It was not until 1867, however, when the Hayden Geological Survey began a series of explorations of the Northwest Territories, that the fauna and flora of the shales were systematically studied. At that time Dr. F. V. Hayden, the director of the survey, named and described the deposit as follows (1873): "A little east of Rock Spring station [Wyoming] a new group commences composed of thinly laminated chalky shales, which I have called the Green River shales because they are best displayed along the Green River. They are evidently of purely fresh water origin and of middle Tertiary age. The layers are nearly horizontal and, as shown in the valley of Green River, present a peculiarly banded appearance. . . . The flora is already extensive, and the fauna consists of Melanias, Corbulas, and vast quantities of fresh water fishes. There are also numerous insects and other small undetermined fossils in the asphalt slates."

As these geological explorations continued, it became apparent that the same shales extended into Colorado, Utah, and other parts of Wyoming (Emmons, 1877; Endlich, 1878; Peale, 1876; White, 1878). In recent times more detailed studies on the geology of the formation have been made by Winchester (1923) and Bradley (1926). The shales were

[1] Since this paper was written (1928) a few ants have also been found in the Miocene (Latah) of Washington, and a single specimen has been collected in the Eocene (Wilcox) of Tennessee.

originally supposed to have been deposited by a large lake, some three hundred miles long and one hundred and fifty miles wide, and containing fresh water, as mentioned by Hayden in the description quoted above. Evidence accumulated within the past two years, however, indicates that the beds were formed by a number of small lakes, with a saline content at least part of the time (Bradley, 1926; Henderson, 1926; Cockerell, 1926).

Studies on the plants of the formation have determined the geological age as approximately middle Eocene. Knowlton (1922) in his excellent revision of the flora lists eighty-four species of plants and presents some interesting conclusions on the environment of the biota: "... It appears that an overwhelming preponderance of the living forms in the families represented in the Green River flora are inhabitants of tropical or subtropical regions, many of them in both hemispheres, yet a considerable number include either genera or species that extend into temperate regions. ... The physical setting can be pictured somewhat as follows: about the shores of the lake were certain flat, low-lying areas, some of them probably swampy, others sandy, whereon grew the palms, figs, Lomatia, Oreodaphne, hackberries, the several papilionaceous trees and shrubs, the ferns, grass, sedge, etc., and in the water the pickerel weed, Brasenia, algae, etc. On the adjacent somewhat higher land might have been the willows, waxberries, sweet fern, walnuts, oaks, sumacs, maples (?), hollies, etc. ... The conditions of temperature and moisture under which the Green River flora flourished are somewhat difficult of interpretation, as there is seemingly more or less conflict between the elements of the flora. The nearest living relatives of certain of the genera that are believed to have inhabited the lowlands ... are found mainly in tropical and subtropical areas. The palms, at least one species of which existed in abundance, could hardly have lived where the temperature fell below 42° F. and probably not even where it was considerably higher than this. ... The upland flora ... could well have withstood some degree of frost, but on the other hand all these genera contain species that could find a congenial habitat in a warm temperate region. It is doubtful if any of them had to withstand cutting frosts."

The insect fauna of the formation contains nearly 300 described species and is not very different from that of the region at the present time. The abundance of the Fulgoridae, however, is rather striking, and Cockerell (1920) believes that these insects have a certain tropical appearance and resemble tropical genera. On the other hand, Alexander (1920) considers that the tipulid fauna is typical of that of the

north temperate region, so that the insects, as well as the plants, appear to show both tropical and temperate affinities.

The only other American Eocene deposit to yield fossil ants is at Mossy Creek, about three miles southwest of Wellborn, Brazos County, Texas. The beds, which belong to the Jackson series, consist at this outcrop of kaolinite lenses in sandstone, and contain twenty-four species of plants, including a common *Combretum* and the littoral palm, *Nipadites*. Professor E. W. Berry (1924) has concluded more or less tentatively, from his study of the flora, that the latter is indicative of a subtropical climate and a strictly coastal location. The insect fauna is very little known, only two species having been described.

The deposit at Quesnel, British Columbia, consists chiefly of fine grayish and greenish-white clays. The age of the formation is still somewhat uncertain, but the latest researches point to the Miocene (Reinecke, 1920). The flora is badly in need of revision, and since the insect fauna is a small one, nothing definite can be said of the climatic conditions under which the biota existed.

The two remaining ant deposits also belong to the Miocene and appear to be very similar as to fauna and flora. The smaller of these is the oil shale of Elko and its vicinity, in Nevada. No fossil insects have previously been described from this outcrop or, in fact, from any other rocks in the state, although the presence of insects has been recognized since Emmons's explorations during 1867–73. In his report on the geology of the region (1877) he states, "Adjoining the coal beds are fine bituminous shales, which closely resemble the brown paper shales of the Green River series at Green River City, Wyoming. In these are found the same plentiful remains of fishes, and also occasional insects." The geology of this bed was more carefully investigated by Winchester (1923), who states that "the shales . . . are in part clean clay shales but are mainly sandy. They usually lack sharp and distinct lamination and are generally interbedded with thin layers of muddy sandstone. In color they are commonly light gray, bluish gray, or brown. . . . Very thinly laminated paper shales are common at certain horizons." These strata have yielded a few fossil plants, which have been referred to the following genera (Knowlton, 1919): *Comptonia*, *Carpinus*, *Fagus*, *Ficus*, *Lycopodium*, *Myrica*, *Planera*, *Populus*, *Salix*, *Sapotacites*, *Sequoia*, and *Thuja*. Lesquereux, who first studied the flora, believed (1878) that the beds were the same age as those at Florissant, and Cope came to this conclusion from his studies on the fishes. At that time the Florissant shales were placed in the late Eocene or Oligocene, but further researches by Cockerell, Henderson, and Knowlton have

shown that they belong to the Miocene. In 1919 Knowlton definitely referred the Elko shales to this latter horizon, and this decision was later substantiated by the discovery of a Miocene mammal in the deposit (Winchester, 1923). The bed covers only a small area, not over thirty square miles, and appears to have been laid down by a fresh water lake under climatic conditions not unlike those which existed at Florissant during the Miocene. The only insects from this deposit which I have been able to locate are in the Museum of Comparative Zoölogy, and were collected by S. W. Garman in the thinly laminated paper shales about twenty miles northeast of the Elko station.

The other Miocene ant beds are the Florissant shales, which are located about thirty miles west of Colorado Springs, Colorado. Scudder's description of the location of the deposit is so admirable that I quote his own words: "By climbing a neighboring peak, thrice baptized as Crystal Mountain, Topaz Butte, and Cheops Pyramid, and known to the old miners as Slim Jim, we obtain an admirable view of the ancient lake and the surrounding region. To the southeast is Pike's Peak; to the west, South Park and the cañon of the South Platte, shown by a depression; to the extreme south the Grand Cañon of the Arkansas; while to the north a few sharp, ragged, granite peaks surmount the low wooded hills and ravines characteristic of the nearer region. Among these hills and ravines, and only a little broader than the rest of the latter, lies to the south, the ancient Florissant Lake basin, marked by an irregular L-shaped grassy meadow, the southern half broader and more rolling than the northwestern, the latter more broken and with deeper inlets." This deposit, which has produced more insects than any other known locality, was found to be fossiliferous by A. C. Peale in 1876. The geology and stratigraphy have been discussed in detail by a number of investigators, so only a brief survey of that aspect will be presented here. The upper part of the formation alone is fossiliferous, and this is composed of strata which vary much in thickness and composition, although for the most part volcanic ash, sand, and mud are the constituents. The shales apparently had their origin at the bottom of a lake, in the vicinity of which were a number of active volcanoes. The dust and ashes from the frequent eruptions of these volcanoes fell to the surface of the lake, carrying along the insects which happened to be flying or blown over the water, and quickly entombed them in a matrix of ash, sand and mud. Leaves of trees and shrubs, torn from their branches by violent winds and falling cinders, are exceedingly common in these shales. The flora of the deposit, which has been studied mainly by Lesquereux (1878, 1883), Kirchner (1878), Cockerell

(1908), and Knowlton (1917), includes such genera as *Acacia, Acer, Alnus, Amelanchier, Aster, Betula, Carpinus, Comptonia, Ficus, Fraxinus, Hicoria, Ilex, Juglans, Magnolia, Myrica, Pinus, Populus, Quercus, Rhamnus, Rhus, Rosa, Salix, Sequoia, Smilax,* and *Ulmus.*

The insect fauna is exceptionally large, over a thousand species having been described, and seems to be modern in most respects. Both the insects and the plants suggest that the climate at the time of the deposition of the shales was similar to that of our southern states. Scudder has frequently observed that some of the insects have subtropical and even tropical affinities, and Cockerell has also called attention (1907) to a few genera which are now restricted to the old world (e.g. *Glossina*). The ant fauna shows this same geographical relationship.

III. The Eocene Ant Fauna

1. The Green River formation, belonging to the Middle Eocene, contains the oldest ants known.[1] The only other ant deposits of Eocene age are the Bagshot beds, England, and the Fayette sandstone, Texas, both of which are somewhat younger than the Green River. The shales of this latter formation also have the distinction of being the first American rocks to produce Tertiary insects, one of the first specimens collected being an ant. In 1865, Professor William Denton, of Boston, discovered a series of Tertiary beds at the Junction of the Green and White Rivers, near the Colorado-Utah border (Fossil Cañon and Chagrin Valley). During the course of his examination of the petroleum shales which formed a part of the deposit, he found numbers of "Dipterous insects, especially mosquitos, and their larvae" (Denton, 1866). The insects were examined by Scudder who reported that the collection consisted of ninety specimens, representing sixty-five species, one of which belonged to *Myrmica.* This ant Scudder later concluded to be a dolichoderine, and described it as *Liometopum pingue.* Three years later, Dr. F. V. Hayden, who conducted many geological explorations into the Northwest Territories, found a few insects in a bed of these same petroleum shales which were exposed along a section ("Petrified Fish Cut") of the then recently built Union Pacific Railroad, at Green River City, Wyoming. Scudder studied these insects also, and stated that they belonged to "three species, one being an ant, the others flies. The ant is rather poorly preserved, and must be examined with great care before its precise characters can be determined." This species was

[1] An earlier ant, *Euponera berryi* Carp., has recently been found in the Lower Eocene of Tennessee. See Journ. Wash. Acad. Sci., **19**, p. 300–301, 1929.

eventually described as *Lasius terreus*. During 1870 Scudder himself collected in these shales, both at the Wyoming and Utah exposures. In more recent times, ants have also been taken in this formation by Mr. Earl Douglass (1908, 1923), Mr. J. L. Kay (1923), Mr. Dean Winchester (1916), and Professor and Mrs. T. D. A. Cockerell (1922).

Although five supposed ants have been described from the Green River shales, only the one following is well enough preserved so that it can be placed in a subfamily with any degree of certainty. I am unable to add anything definite to the original description of the genus or species.

Myrmicinae

Archimyrmex Cockerell

Cockerell, T. D. A., 1923. Entomologist, **56**, p. 51–52.

"Rather large, elongated ants, with a general resemblance to *Myrmecia*, but with the eyes (as in *Prionomyrmex*) high up on the side of the head; the epinotum with a distinct elevation (presumably pair of elevations), placed as in *Ectatomma tuberculatum*, but large and obtuse; mandibles less elongate, but still long, the cutting edge with coarse, obtuse teeth, between which are smaller ones; femora apparently shorter than in *Myrmecia;* first joint of pedicel elongated, with a dorsal elevation beyond the middle, the joint less massive than in the other two genera, but similar in principle to that of *Myrmecia vindex* Smith; second joint large and robust, quite like that of Myrmecia, as also the gaster."

Genotype.— *Archimyrmex rostratus* Ckll.

Archimyrmex rostratus Ckll.

(Plate **2**, fig. 5)

Cockerell, T. D. A., 1923. Entomologist, **56**, p. 51–52.
Wheeler, W. M., 1928. Soc. ins., p. 117.

"Worker: Color as preserved brown, the upper part of head and the gaster blackened, the coloration perhaps originally similar to that of *Myrmecia vindex* var. *nigraceps* Mayr. Length nearly 16 mm.; head with mandibles about 4 mm.; thorax about 5.3 mm.; middle femur about 3.7 mm."

Locality.— Roan Mountain, Colorado (Ute Trail).

Holotype.— Obverse, no. 15174, University of Colorado; reverse, no. 69617, U. S. N. M.

In his original description Cockerell regarded this ant as a ponerine, because of the apparent constriction at about the middle of the gaster. Wheeler, however, concluded (1928) from Cockerell's figure that "the specimen is more probably a Myrmicine. This is suggested by the shape of the petiole, the blunt or broken (?) spine on the epinotum and the shape of the head, which is unlike that of the existing Ponerinae." Through the kindness of Dr. R. S. Bassler I was able to study and photograph the reverse of the type at the National Museum. The obverse, at the University of Colorado, I was also permitted to examine, but was not able to secure a satisfactory photograph because of the lack of the necessary apparatus. My observations on these fossils did not aid materially in determining the affinities of the ant, although I believe that what appears to be an epinotal spine is merely the only part of the epinotum which is exposed to its dorsal surface, the adjoining parts of the epinotum being covered by the matrix of the rock. In as much as the specimen was a holotype, however, no attempt was made to test this conclusion by exposing the hidden part of the thorax. The habitus of the insect is certainly more suggestive of a myrmicine than a ponerine.

The two following Green River species, although unquestionably ants, are not sufficiently well known to permit even subfamily classification.

Eoformica pingue (Scudder)

(Plate **2**, fig. 6)

Liometopum pingue, Scudder, S. H., 1877. Bull. U. S. Geol. Geogr. Surv. Terr., **3**, p. 742–743.
Liometopum pingue, Scudder, S. H., 1890. Bull. U. S. Geol. Surv., **13**, p. 617.
Eoformica eocenica, Cockerell, T. D. A., 1921. Proc. U. S. Nat. Mus., **59**, p. 38.
Eoformica eocenica, Wheeler, W. M., 1928. Soc. Ins., p. 117.

Male.— Length, 7.5 mm.; head small, nearly round, but somewhat broader behind; thorax broad, about twice as wide, and more than twice as long as the head; gaster rounded, about twice as long as the head and somewhat broader. Length of head, 1.2 mm.; thorax, 3.0 mm.; gaster, 2.7 mm. Width of head, 1.2 mm.; thorax, 2.2 mm.; gaster, 2.7 mm.

Locality.— Green River City, Wyoming; Rio Blanco County, Colorado; Uinta County, Utah.

Holotype.— No. 2937, M. C. Z.

This species was originally referred by Scudder to the genus *Liome-*

topum, but none of the known specimens are sufficiently well preserved to warrant this conclusion. In 1921 Cockerell described an ant (no. 66932, U. S. N. M.) from the Green River shales as *Eoformica coccnica*, for which he established a new genus. At the end of his description he suggested that this species might be identical with Scudder's *Liometopum pingue*, and my comparison of the two types shows that this really is the case. Cockerell attempted a restoration of the frontal view of the head of this species, although the only specimen which he saw presented a lateral aspect of the insect. Through the courtesy of the National Museum I was able to make a careful study of the fossil which Cockerell used as the basis of this restoration, but could not discern any definite indications of the eyes or mandibles shown in his figures. If either of Cockerell's drawings (which do not agree in certain details) represent the true characteristics of the ant, the species can have only the remotest affinities with *Formica* or *Liometopum*.

Regardless of the vague relationships of this insect, there are several noteworthy features associated with it. Although none of the other Green River ants is known from more than a single specimen, I have seen twenty-six individuals of *E. pingue*, all of which are males. The wide distribution over the various outcrops of the Green River formation is also remarkable. Scudder's specimens were collected at Fossil Cañon, White River, Utah (Denton), and Green River, Wyoming (Packard); and the one described by Cockerell as *Eoformica coccnica*, at Cathedral Bluffs, Colorado. The additional fossils which I have examined represent the following localities: Wagon Hound Cañon, Uinta County, Utah (Douglass); White River Cañon, Uinta County, Utah (Kay); White River, Uinta County, Utah (Douglass); Roan Mountains, Rio Blanco County, Colorado (Winchester and Cockerell); Dripping Rock Cañon, Rio Blanco County, Colorado (Douglass); and Green River, Wyoming (Winchester). If the species were not so common at the localities mentioned, which are spread over an area of about 34,000 miles, one might easily assume that the relative abundance of individuals was due to the drowning of a number of specimens of a single nuptial flight, which happened to be directed over the lake. But the regular occurrence of the species over so large an area is conclusive evidence that this ant was in reality the commonest in the vicinity of the Green River lakes. That the species also existed in the region for a long period is evinced by the presence of specimens at various levels of the shales, which at some exposures exceed a thousand feet in thickness.

(Formicidae) terreus (Scudder)

Lasius terreus, Scudder, S. H., 1878. Bull. U. S. Geol. Geogr. Surv. Terr., **4**, p. 747–748.

Lasius terreus, Scudder, S. H., 1890. Bull. U. S. Geol. Surv. Terr., **13**, p. 618; pl. 10, fig. 23.

Worker (?).— Length, 7.5 mm.; "head small, rounded, with antennae shaped as in Lasius, but of which the number and relative length of the joints cannot be determined from their obscurity; the long basal joint, however, appears to be comparatively short and of uniform size, being not quite so long as the width of the head, while the rest of the antenna is more than half as long as the basal joint and thickens very slightly near the apex. The thorax, preserved so as to show more of a dorsal than a lateral view, is compact, oval, less than twice as long as broad, with no deep separation between the meso- and metathorax, tapering a little posteriorly. The peduncle, as preserved, is a minute circular joint, but from its discoloration appears to have had a regular, rounded, posterior eminence. The abdomen consists of five joints, is very short, oval, compact and regular, and of about the size of the thorax, although rounder." Length of head, 1.4 mm.; thorax, 3.3 mm.; gaster, 3.0 mm. Width of head, 1.0 mm.; thorax, 1.9 mm.; gaster, 2.2 mm.

Locality.— Green River City, Wyoming.

Holotype.— No. 69618 U. S. N. M.

The single specimen of this species is very poorly preserved, and since I have not been able to discern in the type many of the characters given by Scudder in the description quoted above, it is very probable that the fossil has deteriorated since Scudder's examination of it. The assignment of this species to *Lasius* or any other existing genus will not be justified until additional specimens have been found.

The two following Green River insects described by Scudder as ants do not really belong to the family, but apparently to some other groups of aculeate Hymenoptera:

"Myrmica sp." Scudder

Scudder, S. H., 1878. Bull. U. S. Geol. Geogr. Surv. Terr., **4**, p. 748.

"Camponotus vetus" Scudder

Scudder, S. H., 1877. Bull. U. S. Geol. Geogr. Surv. Terr., **3**, p. 742.

In addition to the preceding fossils I have seen four other ants from the Green River formation, collected by Mr. Earl Douglass in Uinta

County, Utah. One of these, an isolated specimen, is possibly a ponerine queen; the remaining three, which are close together on a small slab of the shale, seem to belong to different genera, but they are so poorly preserved that their generic affinities cannot definitely be ascertained. At any rate, these four species, together with the three discussed above, are sufficient to show that the ant fauna of the Middle Eocene was essentially a modern one, at least to the extent that several of the living families were already established and the castes differentiated.

2. The kaolinite of the Jackson formation (Upper Eocene) has yielded a single, splendidly preserved forewing of an ant.

(Formicidae) eoptera (Ckll.)

Formica eoptera, Cockerell, T. D. A., 1923. Amer. Journ. Sci., **5** (29), p. 399–400.

"Anterior wing, 11 mm. long and 4 wide; hyaline, faintly reddish, with pale but stout veins; stigma lanceolate, slender; costal cell very slender; basal nervure with upper section only slightly out of straight line with lower, the lower distinctly but not much longer; nervulus about 1.6 mm. basad of basal nervure; discoidal cell large, subquadrate, but narrower above than below, and apically broader than basally, the upper basal corner obtuse; marginal cell long and broad, its inner corner acute; marginal and cubital nervures forming a cross as in Camponotus."

Locality.— Mossy Creek, Brazos County, Texas.

The holotype of this insect appears to be lost; it is not recorded at the National Museum, where the rest of Professor Berry's types are located.

As Wheeler has already pointed out (1928), a generic determination of this ant is impossible.

IV. The Miocene Ant Fauna

1. The ant fauna of the Quesnel clays (Fraser Formation) is even more fragmentarily known than that of Green River; only four specimens have been found and these are so poorly preserved that very little can be said of their affinities. The species represented by these fossils were described by Scudder, three of them as ants and the fourth as a brachonid.

(Dolichoderinae) obliterata (Scudder)

Hypoclinea obliterata, Scudder, S. H., 1877. Rep. Progr. Geol. Surv. Can., 1875–76, p. 267.

Hypoclinea obliterata, Scudder, S. H., 1890. Bull. U. S. Geol. Surv., **13**, p. 616, pl. 3, fig. 25, 26.

The specimen from which this ant was described consists only of the gaster, the posterior half of the thorax, and a forewing. Since the pedicel is apparently single jointed and the wing has two cubital cells, the species is probably a dolichoderine, but there is no evidence whatever that it belongs to Dolichoderus.

Holotype.— Obverse, no. 6179, Canadian Geological Survey; reverse, no. 2938, M. C. Z.

(Myrmicinae) longaeva (Scudder)

Aphaenogaster longaeva, Scudder, S. H., 1877. Rep. Progr. Geol. Surv. Can., 1875–76, p. 267.

Aphaenogaster longaeva, Scudder, S. H., 1890. Bull. U. S. Geol. Surv., **13**, p. 61, pl. 13, fig. 24.

The forewing and some parts of the body are preserved; the pedicel is typically myrmicine, but no generic determination can be made.

Holotype.— Obverse, no. 6178, Canadian Geological Survey; reverse, no. 2939, M. C. Z.

(Formicidae) arcana (Scudder)

Formica arcana, Scudder, S. H., 1877. Rep. Progr. Geol. Surv. Can., 1875–76, p. 266–67.

Formica arcana, Scudder, S. H., 1890. Bull. U. S. Geol. Surv., **13**, p. 618, pl. 13, fig. 24.

This ant is represented by a forewing, possessing a cubital and discoidal cell, and consequently might belong to any one of a number of genera.

Holotype.— No. 6180, Canadian Geological Survey.

(Formicidae) antediluvianum (Scudder)

Calyptites antediluvianum, Scudder, S. H., 1878. Rep. Progr. Geol. Surv. Can., 1876–77, p. 270.

Calyptites antediluvianum, Wheeler, W. M., 1908. Journ. f. Psych. u. Neurol., **13**, p. 417.

This species, based on one specimen consisting of a forewing, was originally described by Scudder as a braconid, but it is really a formicid with uncertain generic affinities.

Holotype.— Canadian Geological Survey.

2. The oil shales at Elko, Nevada, have contributed one fossil ant, which, although poorly preserved and much distorted, is nevertheless described below because it represents a new locality for the family, and even for the insects as a whole.

Formicinae

Pseudocamponotus, gen. nov.

Similar to *Camponotus* but with the eyes and antennal insertions farther forward on the head; antennae consisting of twelve segments in the female.

Genotype.— *Ps. elkoanus*, sp. nov.

Pseudocamponotus elkoanus, sp. nov.

Plate **2**, fig. 2

Female.—Length, 7.0 mm. Head quadrate, a little longer than broad; mandibles massive, triangular; clypeus large, the anterior border with a small tooth on each side of a median notch, the posterior margin with a lobe extending back nearly to the middle of the head; eyes small, situated at about the middle of the sides of the head; scape just reaching the posterior margin of the head, slender; funicular segments subequal, about as long as broad; thorax about as long and as broad as the head; petiole apparently rather wide; gaster small, only a little longer than the head, rounded. Length of head, 1.8 mm.; scape, 122 mm.; funiculus, 1.8 mm.; thorax, 2.0 mm.; gaster, 2.4 mm.; forewing, 6.0 mm. Width of head, 1.3 mm.; thorax, 1.2 mm.; gaster, 2.0 mm.

Locality.— Near Elko, Nevada, "20 miles or more northeast from the station, from a shaft sunk by the Central Pacific Railroad Company." (S. W. Garman).

Holotype.— No. 2940, M. C. Z.

The obscurity of the petiole and venation of this species prevents the generic affinities from being accurately determined. The habitus is nearest to that of the Camponotini, with the exception of the position of the eyes and the antennal insertions, so that until additional material

has been found the species had probably best be assigned to a new genus within this tribe. Professor Wheeler has suggested to me that the prolongation of the clypeus gives somewhat the appearance of the truncated head of the subgenus *Colobopsis*, and this character would agree with the structure of the mandibles as indicating that the ant was a wood-inhabiting species.

The Florissant shales have produced more fossil ants than any of the other deposits, excepting, of course, the Baltic amber. Scudder remarks in his volume on the Tertiary insects of North America that "the ants are the most numerous of all the insects at Florissant, comprising, perhaps, a fourth of all the specimens; they form more than three-fourths, perhaps four-fifths, of all the Hymenoptera; I have already about four thousand specimens of perhaps fifty species (very likely many more)." Some four thousand additional specimens were obtained by the expeditions conducted after 1900, and Mr. S. A. Rohwer tells me that a great number of poorly preserved ants were discarded at the locality. Still further evidence of the abundance of the ants at the time of the existence of the Florissant biota is afforded by the presence of many specimens of fossil fish excrement, apparently consisting of the "hard, indigestible heads of ants" (Wheeler, 1910).

About half of the 12,000 specimens which I have examined are well enough preserved to permit specific determination, and nearly a half of the remainder show details sufficient for generic diagnosis. By far the majority of the specimens are males and females, which are nearly equally represented; only about two per cent. are workers. This scarcity of neuters is obviously due to their inability to fly over the lake, for since only a relatively few specimens were blown from the trees or shrubs into the water, they were rarely preserved as fossils. The same deficiency of workers was observed by Heer in his study of the ants in the Oeningen beds, in which "mit einigen wenigen Ausnehmen finden sich nur geflugelte Individuen vor, weil die ungeflugelten Thiere, hier also die geschechtslosen Individuen, viel seltener im Wasser verungluchten, als die ersteren." The opposite tendency is naturally found in the Baltic amber fauna, most of which "are workers and belong to more or less arboreal species, but there are also quite a number of males and females. As nearly all of the latter have wings, they must have been caught in the liquid resin just before or after the nuptial flight." (Wheeler, 1910.)

The correlation of the castes of the Florissant ants is very difficult. This is especially so because the females and males of a species do not usually occur even in an approximately equal abundance. The com-

monest female, for example, is that of *Protazteca elongata*, sp. nov., while the most abundant male is that of *Lasius peritulus* (Ckll.). An even better illustration is afforded by *Miomyrmex impactus* (Ckll.) and *M. striatus*, sp. nov., the former of which is represented by thirty-seven females and one male, and the latter by two females and fifteen males. The determination of the affinities of the males has been exceedingly troublesome, partly because this caste has been so little used in the taxonomy of existing ants, and partly because of the slight generic differentiation of this sex.

The number of species of Florissant ants was estimated by Scudder to be close to fifty, but this is considerably more than the actual amount. Thirty-two species are described below and although a few others may turn up in later collections, the total number will probably not exceed forty. These species are distributed among five of the seven recognized subfamilies. The following list shows the abundance of the species, and the table summarizes the ant faunas of the Florissant shales and the Baltic amber, so that they may be easily compared.

Name	Sexes known	No. of Specimens
Archiponera wheeleri, sp. nov.	☿ ♂	2
Pseudomyrma extincta, sp. nov.	♀	2
Aphaenogaster mayri, sp. nov.	☿ ♂ ♀	200
Aphaenogaster donisthorpei, sp. nov.	♀	1
Pheidole tertiaria, sp. nov.	♀	2
Messor sculpturatus, sp. nov.	♀	20
Pogonomyrmex fossilis, sp. nov.	☿	1
Lithomyrmex rugosus, sp. nov.	♂ ♀	40
Lithomyrmex striatus, sp. nov.	☿ ♀	2
Cephalomyrmex rotundatus, sp. nov.	♀	1
Mianeuretus mirabilis, sp. nov.	♀	1
Dolichoderus antiquus, sp. nov.	☿ ? ♀	10
Dolichoderus rohweri, sp. nov.	☿ ♀	7
Protazteca elongata, sp. nov.	☿ ♂ ♀	1,500
Protazteca quadrata, sp. nov.	☿ ♀	50
Protazteca capitata, sp. nov.	☿ ? ♀	30
Liometopum miocenicum, sp. nov.	☿ ♂ ♀	1,500
Liometopum scudderi, sp. nov.	☿ ♀	200
Elaeomyrmex gracilis, sp. nov.	☿ ♀	50
Elaeomyrmex coloradensis, sp. nov.	☿ ♀	29
Iridomyrmex florissantius, sp. nov.	♀	34
Iridomyrmex obscurans, sp. nov.	♀	26
Miomyrmex impactus (Ckll.)	☿ ♂ ♀	38
Miomyrmex striatus, sp. nov.	♂ ♀	17

Name	Sexes known	No. of Specimens
Petracomyrmex minimus, sp. nov.	♀	11
Formica robusta, sp. nov.	♂ ♀	400
Formica cockerelli, sp. nov.	♂ ♀	5
Formica grandis, sp. nov.	♀	1
Lasius peritulus (Ckll.)	♂ ♀	1,400
Camponotus fuscipennis, sp. nov.	♀	4
Camponotus microcephalus, sp. nov.	♀	1
Camponotus petrifactus, sp. nov.	☿	7

FLORISSANT

Subfamily	Extinct genera	Extant genera	Species	Individuals
Ponerinae	1	0	1	2
Pseudomyrminae	0	1	1	2
Myrmicinae	2	4	8	267
Dolichoderinae	5	4	15	3,505
Formicinae	0	3	7	1,818
	8	12	32	

BALTIC AMBER

Subfamily	Extinct genera	Extant genera	Species	Individuals
Ponerinae	3	4	8	106
Cerapachinae	1	0	2	6
Pseudomyrminae	0	1	5	18
Myrmicinae	7	7	25	214
Dolichoderinae	4	3	20	7,508
Formicinae	5	8	32	3,827
	20	23	92	

From these tables it is obvious that the subfamily Dolichoderinae is the predominant one of the Florissant ant fauna in all respects — numbers of genera, species and individuals. The Formicinae rank second as to the number of individuals present, but are exceeded by the Myrmicinae in the number of genera and species. It will be noted that in the amber fauna the Dolichoderinae lead only as to the number of individuals, the Myrmicinae as to the number of genera, and the

Formicinae as to the number of species. The large number of dolichoderine individuals in the amber is due, however, to the excessive abundance of one species, *Iridomyrmex goepperti* Mayr, of which 5,428 specimens have been found.

It is also evident from the foregoing list that on a basis of their geographical distribution the genera of Florissant ants (excepting those extinct ones whose affinities are not recognized) may be divided into three groups:

1. Those now present in Colorado or neighboring states. As one would expect most of the genera fall within this category, as *Pseudomyrma, Pheidole, Aphaenogaster, Pogonomyrmex, Liometopum, Iridomyrmex, Formica, Lasius,* and *Camponotus.*

2. Those which represent a definite neotropical element. Here belong *Archiponera,* gen. nov. (affin. *Dinoponera*) and *Protazteca,* gen. nov. (affin. *Azteca*).

3. Those which represent the old-world fauna, as *Messor* and *Mianeuretus,* gen. nov. (affin. *Aneuretus*).

The significance of this combination of faunas will be discussed later, but it might be noted here that the Baltic amber ants as well are "a mixture of what at the present day we are able to recognize as at least four different faunas, the palearctic, the Indian, the Malayan, and the Australian, with a little more than one-third the genera and nearly one-half of the species palearctic and the remainder belonging to Indomalayan and Australian types." (Wheeler, 1914.)

Comparing the relative numbers of extinct and living ant genera in the amber and Florissant shales, it is interesting to note that 44.1% of the former, and 40% of the latter are extinct. This close agreement is about what should be expected in view of the short interval of time between the Oligocene and the Miocene. It is also instructive to compare the relative number of extinct genera in the other groups of Florissant insects which have been sufficiently well treated. Of the parasitic Hymenoptera, which were studied by Professor C. T. Brues (1910), about 13% of the genera are no longer living. The great difference between this percentage and that of the ants is probably largely due to the fact that in determining the affinities of the fossils Professor Brues was obliged to consider the genera in a somewhat broader sense than has been done with the ants. The Coleoptera, which have been studied very thoroughly by Professor H. F. Wickham, are mainly represented by living genera also, less than 20% being extinct. This is not surprising, however, if we bear in mind that this order is geologically much older than the Hymenoptera, and that many of the living families were well established during the Triassic.

Ponerinae

The Florissant collection contains but a single recognizable species of this subfamily. There are two poorly preserved male ants in the Scudder material which may possibly belong here also, but they are too obscure for description. Cockerell has described a species which he placed in *Ponera* (1906) and later in *Euponera* (1927), but this ant is really a dolichoderine and will be discussed under the new genus *Protazteca*.

Ponerini

Archiponera, gen. nov.

Allied to *Dinoponera* and *Streblognathus*.

Worker.— Head large, with convex sides and broadly rounded posterior angles; mandibles small, linear; clypeus large, anterior margin with a median incision, posterior margin with a large median lobe; eyes small, situated very high up on the sides of the head, a little posterior of the middle line of the head; ocelli absent; antennae long and slender, twelve-jointed; petiole short but high, cuneiform; gaster small, globular, the first two segments of moderate size, the others short and compressed.

Male.— Slender; petiole long, with a low scale; forewing with two cubital cells, the first intercubitus joining the cubitus at a point much above the junction of the latter with the recurrent vein; second intercubitus far apical of the termination of the first intercubitus.

Genotype.— *Archiponera wheeleri*, sp. nov.

Archiponera wheeleri, sp. nov.

Plate 1. Plate 2, fig. 1

Worker.— Length, 15.0 mm. Head nearly round, as broad as long; posterior margin slightly concaved; scapes greatly exceeding the posterior margin of the head; first six and last funicular segments about twice as long as broad, the others only about as long as broad; thorax as long as the head, but only a little more than half as broad; gaster only a very little longer than the head, and not as wide. Length of head, 4.5 mm.; scape, 3.0 mm.; funiculus, 4.0 mm.; thorax, 4.5 mm.; gaster, 5.0 mm. Width of head, 4.5 mm.; thorax, 2.3 mm.; gaster, 3.0 mm.

Holotype (♀). — No. 2876a-b, M. C. Z. (S. H. Scudder).

The specimen on which this species is based is an example of the remarkable preservation which occasionally occurs among Florissant fossils. Not only are the minute structures preserved in detail, but the whole insect stands out in such strong relief that the dorsal outline of the body can be ascertained by regarding the fossil from the side. There is not the slightest indication of distortion, the insect being perfectly symmetrical, in a normal, straight position, so that from the photograph one could easily imagine that the figure had been engraved on the rock. The existence of such strong relief is, of course, proof that distortion by flattening has been reduced to a minimum. It will be observed, however, that this conclusion is apparently contrary to the evidence afforded by the remoteness of the eyes from the lateral margins of the head, for, as was shown above, this condition usually results from flattening. This contradiction is at once removed and additional proof of the systematic position of the ant is furnished by comparing extant species of *Streblognathus*, *Dinoponera*, and allied genera, for in these forms the eyes are actually on the dorsal surface of the head rather than the sides, and from a dorsal aspect appear in precisely the same position as they do in the fossil. It will be observed also that only the first two gastric segments appear to be preserved, but a careful examination of the reverse of the specimen reveals the remaining segments compressed together and curled under the second segment. This is a condition frequently found in specimens of *Dinoponera*, which from a dorsal view show only the first two segments.

The constriction between the first and second gastric segments is very marked (see Plate 2), leaving no question that this ant is a ponerine. The linear mandibles, the form of the clypeus and petiole, as well as the characters mentioned above, place it very close to *Dinoponera* and *Streblognathus*. It differs from each of these genera in the more rounded head, and also by the lack of the blunt tooth on the sides on the median emargination of the anterior margin of the clypeus.

Inasmuch as the female of *Streblognathus* or *Dinoponera* is not known, I hoped to find the queen of *A. wheeleri*, sp. nov., in the Florissant collection, but only the male turned up. Unfortunately, the head of this latter specimen is not preserved, apparently having been separated from the thorax before the insect was entombed in the mud at the bottom of the lake. Nevertheless, there are sufficient details present to associate definitely this fossil with the above worker. The male has the following characteristics: length, 13.0 mm. Petiole large, the node with a long anterior face (indicated in relief); gaster long and slender; venation nearly identical with that of *Dinoponera grandis*. Length of

thorax, 5.0 mm.; gaster, 7.0 mm.; forewing, 6.00. Width of thorax and gaster, 3.0 mm.

Allotype.— No. 2877, M. C. Z. (W. P. Cockerell).

It will be seen from the above description that the male is much smaller than the worker. This is the reverse of the usual condition in the ants, but is true of *Dinoponera grandis* (Guerin), the worker of which is about 26.0 mm. long and the male only 18.0 mm. The petiole of the male has quite the same appearance as that of *D. grandis* when viewed from above. The venation is of a peculiar, primitive type, found only in such ponerine genera as *Paltothyreus, Dinoponera, Streblognathus,* and *Myrmecia.*

The occurrence of such a ponerine as this in the Miocene of Colorado is of considerable interest in connection with the geographical distribudion of *Streblognathus* and *Dinoponera,* its nearest relatives. Both of these extraordinary genera are monospecific, *S. aethiopicus* (F. Smith) occurring in South Africa, and *D. grandis* (Guerin) in South America. Although these two species are placed in separate genera, distinguished by the structure of the claws and the shape of the petiole, they are closely enough related so that we may regard them as a compact group and representing a supergenus, which during the Pleistocene and perhaps postglacial times was tropicopolitan, and which during the Tertiary extended further northward, where it was represented by *Archiponera wheeleri,* sp. nov., and probably other forms still unknown.

Pseudomyrminae

This subfamily, consisting of one tribe, Pseudomyrmini Forel, includes a few tropical and subtropical species belonging to four genera. Three of these, *Pachysima, Viticiola,* and *Tetraponera* are confined to the old world, the latter genus alone extending as far north as Palestine. *Pseudomyrma* itself is the only genus which occurs in the New World, and this reaches as far north as Texas and Florida. In the Tertiary, however, the subfamily was much more widely distributed, as evinced by the presence of five species in the Baltic amber belonging to *Tetraponera,* and one species of *Pseudomyrma,* described below, from the Florissant shales.

Pseudomyrma, Latr.

Pseudomyrma extincta, sp. nov.

Plate 3, fig. 4

Female.— Length, 9.0 mm. Slender, head elongate-oval, with a short posterior margin and curved lateral margins; scapes very short,

about one-half the length of the head; thorax about as long and as wide as the head; petiole and postpetiole attenuate, the petiole longer and narrower than the postpetiole; gaster slender, nearly two and one-half times as long as the head, but only a little wider; forewing not exceeding the end of the gaster, with two cubital cells. Length of head, 1.8 mm.; thorax, 2.0 mm.; pedicel, 1.2 mm.; gaster, 4.2 mm.; forewing, 5.0 mm. Width of head and thorax, 1.2 mm.; gaster, 1.8 mm.

Holotype.— No. 2899, M. C. Z. (S. H. Scudder).

Paratype.— No. 2900a-b, M. C. Z. (S. H. Scudder).

The holotype, an obverse, appears to be deälated. The species is very rare, only the two types being known.

Myrmicinae

Pheidolini

Aphaenogaster Mayr

This widely distributed genus is represented in the Tertiary formations by three species in the Baltic amber, two in the Radoboj beds, and the three following in the Florissant shales. Scudder's *Aphaenogaster longaeva*, from Quesnel, B. C., cannot be referred to this genus, as shown above.

Aphaenogaster mayri, sp. nov.

Plate **5**, fig. 5. Plate **8**, fig. 4. Plate **9**, fig. 5. Plate **11**, fig. 4.

Female.— Length, 7.0–8.0 mm. Moderately slender; head rather small, longer than broad; posterior margin straight; mandibles large, well developed; scape rather long and slender, exceeding the posterior margin of the head; funicular segments 3–8, about one and one-half times as long as broad, segments 2, 9, 10 a little more than twice as long as broad, and the last segment three times as long as broad; thorax longer than the head and a little broader; epinotum with a pair of short but distinct spines; petiole more or less pedunculate, longer than the post-petiole; gaster small, about one and one-half times the length of the head and about as wide; in many specimens the second and subsequent segments of the gaster are compressed, so that the abdomen seems much smaller. Sculpturing on head and thorax usually distinct. Length of head, 2.1 mm.; scape, 1.5 mm.; funiculus, 2.1 mm.; thorax, 2.5 mm.; gaster, 3.0 mm. Width of head, 1.5 mm.; thorax 1.8 mm.; gaster, 1.5 mm.

Holotype (♀).— No. 2949, M. C. Z. (S. H. Scudder).

Paratypes (♀).— Nos. 2942, 2901–2912, M. C. Z.; no. 1030, Peabody Museum, Yale University; nos. 7845–7849, Princeton University; no. 17016a, Colorado University; no. 78,803, U. S. N. M.; no. 22,966, A. M. N. H.; nos. 36–43, Wickham coll.; no. 10, Carnegie Museum; no. (1), British Museum.

Male.— Length, 6.0 mm. Similar to the female, but with a smaller, more nearly triangular head; funicular segments about twice as long as broad; venation as in the female. Length of head, 1.2 mm.; scape, 0.6 mm.; funiculus, 1.8 mm.; thorax, 1.8 mm.; gaster, 1.8 mm. Width of head, 0.7 mm.; thorax, 0.9 mm.; gaster, 1.5 mm.

Allotype (♂).— No. 2914, M. C. Z.; no. 10031, Peabody Museum; no. 17016b, University of Colorado; no. 78,803, U. S. N. M.

Worker.— Very similar to the female, but smaller, with heavier sculpturing on the head. Length, 6.0 mm.; length of head, 1.5 mm.; scape, 1.1 mm.; funiculus, 2.0 mm.; thorax, 2.0 mm.; gaster. 2.4 mm.

Ergatotype.— No. 2915, M. C. Z. (S. H. Scudder).

Paratypes (☿).— No. 2916, M. C. Z.; no. 17,016c, University of Colorado; no. 78,803, U. S. N. M.

This species, the commonest myrmicine in the Florissant shales, is represented in the material which I have examined by some two hundred good specimens, nearly all of which are queens. The sculpturing on the female is usually discernible, and in some specimens is preserved with remarkable clearness, as in paratype no. 2912a (see Plate 8, fig. 4).

Aphaenogaster donisthorpei, sp. nov.

Plate 7, fig. 4

Female.— Length, about 7.0 mm. Slender; head much longer than broad, elongate-oval; antennae long and slender, the scape greatly exceeding the posterior margin of the head; funicular segments about twice as long as broad; thorax longer than the head, but only about as wide; forewing exceeding the end of the abdomen; venation similar to that of *Aphaenogaster mayri*, sp. nov. Length of head, 1.9 mm.; scape, 1.8 mm.; funiculus, 2.1 mm.; thorax, 2.5 mm.; forewing, 6.0 mm. Width of head and thorax, 1.2 mm.

Holotype.— No. 2917, M. C. Z. (S. H. Scudder).

This species is described from a single specimen, which, although not very well preserved, shows sufficient characters to distinguish it from the other Florissant species. It is much more slender than *A. mayri*, and the scape, head, and thorax are relatively longer.

Messor Forel

This genus, which is now restricted to the tropical and palaearctic regions of the Old World, is represented in the Florissant beds by a fairly common species. The recent genera, *Novomessor* Emery and *Veromessor* Forel are the closest American relatives of *Messor*, but are distinguished from it by the forewing, which has two cubital cells in *Messor* and only one in *Novomessor* and *Veromessor*. The Florissant species, having two closed cubital cells in the forewing, cannot belong to either of the American genera, unless we consider it as representing a new and aberrant subgenus. However, inasmuch as there are no characters sufficient to separate it from *Messor*, it seems advisable to place it within this latter genus. This conclusion seems especially justified in view of the occurrence of other Old World genera in the Florissant shales (e.g. *Glossina*).

Messor sculpturatus, sp. nov.

Plate **4**, fig. 5. Plate **11**, fig. 5

Female.— Length, 10.0 mm. Robust; head large, posterior margin slightly curved, lateral margins a little convex; mandibles well developed; antennae slender, scape reaching the posterior margin of head; funicular segments 3–10 somewhat longer than broad, segments 2, 11, 12 about twice as long as broad; thorax much longer than the head but only about as wide; petiole and postpetiole nearly equal in height, the petiole somewhat longer; gaster small, about one and one-half times as long as the head, but only as wide; forewing exceeding the tip of the gaster. Head, thorax, and petiole with fine, but distinct striations. Length of head, 2.4 mm.; scape, 1.8 mm.; funiculus, 2.2 mm.; thorax, 2.4 mm.; gaster, 3.7 mm.; forewing, 7.0 mm. Width of head, 1.9 mm.; thorax, 1.8 mm.; gaster, 1.8 mm.

Holotype (♀).— No. 2920, M. C. Z. (S. H. Scudder).

Paratypes (♀).— No. 2921, M. C. Z.; no. 10,032, Peabody Museum; no. 7850, Princeton University; no. 17,017a, University of Colorado; no. 78,804, U. S. N. M.; no. 11, Carnegie Museum.

The holotype specimen is very faint, but well preserved. In all, twenty individuals of this species have been found.

Pheidole Westwood

This genus has not previously been recorded from Tertiary strata, although it has a wide and primitive distribution in the tropical, ne-

arctic, and southern palaearctic regions. In the Florissant collection I find two splendid specimens of a single species.

Pheidole tertiaria, sp. nov.

Plate **5**, fig. 2. Plate **11**, fig. 2

Female.— Length, 7.0 mm. Head large, nearly as broad as long, narrowed anteriorly; posterior margin slightly incised; mandibles well developed; antennae situated rather far forward; scapes slender, reaching the posterior margin of the head; funiculus moderately slender, segments 2–9 a little longer than broad, the last three segments enlarged to form a club; eyes small, situated very nearly at the middle of the sides of the head; ocelli unusually large; thorax about as long as the head, but not quite as wide; epinotum (apparently) unarmed; petiole and postpetiole short, but probably quite high; gaster small, as long as the head, and about as wide; forewing extending much beyond the end of the gaster. Head coarsely and reticulately rugose; mesonotum and metanotum also rugose, but not so distinctly. Length of head, 2.3 mm.; scape, 0.12 mm.; funiculus, 2.4 mm.; thorax, 2.3 mm.; gaster, 2.5 mm. Width of head, 1.8 mm.; thorax, 1.6 mm.; gaster, 1.8 mm.

Holotypes.— No. 2918, M. C. Z. (S. H. Scudder).

Paratypes.— No. 2919, M. C. Z.

Both types are well preserved and are obverses, showing the dorsal aspect of the ant. Since there is no indication of epinotal spines in either specimen, I have concluded that the thorax was unarmed, as in *Ph. guilemi-muelleri* Forel.

Myrmicini

Pogonomyrmex Mayr

This neotropical and nearctic genus, of which two species now occur in Colorado, is represented for the first time in the Tertiary by one species in the Florissant beds.

Pogonomyrmex fossilis, sp. nov.

Plate **9**, fig. 6

Worker.— Length, 6.0 mm. Head large, rounded, a little longer than broad, with coarse longitudinal striations, the posterior margin straight, mandibles large; scape inserted close to the posterior margin of the clypeus, short, not reaching the back of the head; funicular segments

2–7, small, about as long as broad, segments 8–12 longer than broad, the last segment much larger than the others; thorax a little longer than the head, but not as wide; gaster small, about the size of the head. Length of head, 1.6 mm.; scape, 1.2 mm.; funiculus, 1.9 mm.; thorax, 1.8 mm.; gaster, 1.9 mm. Width of head, 1.3 mm.; thorax, 0.9 mm.; gaster, 1.2 mm.

Holotype.— No. 2922, M. C. Z. (S. H. Scudder).

Paratypes.— Nos. 2923–2925, M. C. Z.; no. 17,018a, University of Colorado.

Five other, rather poorly preserved specimens are in the Scudder collection. Even the holotype is not well preserved, but from a careful study of all the specimens at hand, I believe there is no question about the systematic position of the species.

Agroecomyrmicini, tribus nov.

Lithomyrmex, gen. nov.

Allied to *Archæomyrmex* Wheeler (Baltic amber).

Female.— Head subquadrate; mandibles small; clypeus large; antennal scrobes present; antennae short, 12-segmented, with a two-jointed club; epinotum not armed; petiole and postpetiole short and compressed, the forewing with two cubital cells; head, thorax, and pedicel, coarsely sculptured.

Male.— Antennae 13-segmented; scape short, but a little longer than the second segment; sculpturing weaker than that of the female; forewing with two cubital cells.

Worker.— Very similar to the female, apparently differing only in the smaller size.

Genotype.— *Lithomyrmex rugosus*, sp. nov.

The two species placed in this genus are among the most unusual of the Florissant ants. The nearest relative of *Lithomyrmex* appears to be a Baltic amber genus, *Archæomyrmex* Wheeler. The single specimen upon which Mayr originally based the species representing the latter genus was a poorly preserved worker, and he placed it in *Myrmica*. Fortunately, Professor Wheeler was able to examine three additional workers as well as a female and consequently to recognize its peculiar characteristics. *Lithomyrmex* is distinguished from *Archæomyrmex* by the smaller mandibles and the large antennal club, but in other respects the two genera are very similar.

The tribe in which Wheeler placed *Archæomyrmex* (1914), has subsequently been restricted so as to embrace only a fraction of the genera

originally included, so that a new tribe is established here to contain the amber genus and its Florissant relative. The tribe Agroecomyrmicini has several characters in common with three existing groups: the Cataulacini, Meranoplini, and Cryptocerini. Its relationship with the first of these, which consist only of the Australian genus *Cataulacus*, is very slight, however, for the forewing in this genus lacks a discoidal cell and has only one cubital cell, and the antennae of the male and female are 11-segmented. In *Agroecomyrmex* and *Lithomyrmex* the wing has a discoidal cell and two cubital cells, the antennae of the female are 12-segmented and those of the male are 13-segmented. Of the Meranoplini, the closest genus to *Agroecomyrmex* is *Promeranoplus*, which is likewise confined to the Australian region. The female of this genus is still unknown, but the worker has 12-segmented antennae and the male, 13-segmented; the forewing of the male, like that of the females of the other known genera of the tribe, has a discoidal and a single cubital cell. In addition to these differences the thorax is quite unlike that of *Agroecomyrmex*. The tribe Cryptocerini, which inhabits neotropical and southern nearctic regions, has the venation of the forewing like that of the Meranoplini; the antennae of the male are 13-segmented, but those of the female are only 11-segmented. However, inasmuch as the 12-segmented condition of the antennae of the female in the Agroecomyrmicini is more primitive than that of 12 segments, I am inclined to believe that this latter tribe represents an earlier stage in the evolutionary process which produced the more highly specialized Cryptocerini.

Lithomyrmex rugosus, sp. nov.

Plate **5**, fig. 1, 3. Plate **8**, fig. 2. Plate **11**, fig. 3

Female.— Length, 8.0 mm. Head longer than broad, posterior and lateral margins straight; mandibles with a stout apical tooth, and a nearly smooth inner margin; scapes not reaching the posterior margin of the head, much broadened apically; funiculus also short, segments 3–9 about twice as broad as long, second segment about as broad as long, the last two segments forming a club, the last segment much larger than the penultimate; thorax a little longer than the head and about as wide; epinotum apparently unarmed; petiole with a small node; postpetiole shorter than the petiole, but higher; gaster small, about as long and broad as the thorax. Head, thorax, and petiole coarsely and reticulately rugose; the postpetiole and entire gaster with a series of coarse longitudinal striations; forewing with a closed dis-

coidal and two cubital cells. Length of head, 2.4 mm.; scape, 1.5 mm.; funiculus, 1.9 mm.; thorax, 2.2 mm.; gaster, 3.3 mm. Width of head, thorax and gaster, 1.8 mm.

Holotype.— No. 2926, M. C. Z. (S. H. Scudder).

Paratypes.— No. 2927a-b, 2931a-b, M. C. Z.; no. 17,019a, University of Colorado.

Male.— Head broader than long; eyes of moderate size; funicular segments about as broad as long, the last three segments somewhat larger than the others; postpetiole larger than the petiole; gaster small, nearly globular; head and thorax reticulately rugose, gaster smooth. Venation as in female. Length, 7.0 mm. Length of head, 0.9 mm.; scape, 1.0 mm.; funiculus, 2.4 mm.; thorax, 2.2 mm.; gaster, 2.7 mm.; forewing, 7.0 mm. Width of head, 1.5 mm.; thorax and gaster, 1.8 mm.

Allotype.— No. 2932, M. C. Z. (S. H. Scudder).

One of the striking features of this ant is the strong sculpturing on the gaster, the striations extending to the very end of the abdomen. As far as I am aware no other fossil or living species has the sculpturing extending that far posteriorly. This species is not a particularly rare one at Florissant; I have seen forty good specimens in the material at my disposal.

Lithomyrmex striatus, sp. nov.

Plate **6**, fig. 1

Female.— Length, 8.0 mm. Head nearly subtriangular; antennal scrobes well developed, probably more so than in *L. rugosus;* funicular segments 3–9 nearly as long as broad, the antennal club not so marked as in the previous species; thorax a little longer than the head and about as broad; postpetiole only a very little longer than the petiole; gaster about the size of the thorax; head rugosely striated, the postpetiole and the base of the gaster faintly striated, most of the gaster without sculpturing. Length of head, 1.9 mm.; scape, 1.0 mm.; funiculus, 1.4 mm.; thorax, 2.1 mm.; gaster, 2.1 mm.; forewing, 4.8 mm. Width of head, 1.3 mm.; thorax, 1.3 mm.; gaster, 1.8 mm.

Holotype.— No. 2933, M. C. Z. (S. H. Scudder).

Worker.— Length, 6.0 mm. Identical with the female except for size. Length of head, 1.8 mm.; thorax, 1.2 mm.; gaster, 3.0 mm.

Ergatotype.— No. 2934, M. C. Z. (S. H. Scudder).

Both castes of this species are represented by uniques, the female by a dorso-ventral specimen, and the worker by a lateral specimen. The worker is rather poorly preserved, but there can be no question as

to its systematic position. The species differs from the preceding in the smaller head, the longer funicular segments, the smaller postpetiole, and especially in the unsculptured gaster.

Tribus incerta

Cephalomyrmex, gen. nov.

Female.— Robust; head exceedingly large, rounded; thorax short; gaster very small; antennae abbreviated, the funiculus apparently with only five or six segments; petiole pedunculate; postpetiole short but broad. (Venation unknown).

Genotype.— *C. rotundatus*, sp. nov.

Cephalomyrmex rotundatus, sp. nov.

Plate 7, fig. 5. Plate 10, fig. 10

Female.— Length, 5.0 mm. Head nearly round, as broad as long; mandibles probably rather large; antennae unusually short, the scape less than one-half the length of the head; funiculus only a little longer than the scape; thorax about as long as the head, but not so broad; gaster much smaller than the head; forewing greatly exceeding the end of the abdomen. Length of head, 1.5 mm.; scape, 0.7 mm.; funiculus, 0.7 mm.; thorax, 1.5 mm.; gaster, 1.2 mm.; forewing, 6.0 mm. Width of head, 1.5 mm.; thorax, 1.2 mm.; gaster, 1.5 mm.

Holotype.— No. 2935, M. C. Z. (S. H. Scudder).

There are not enough details preserved in the single specimen which I have seen to determine definitely the affinities of this very strange ant. The head is proportionally larger than that of the female of any other ant known to me, and the unusually short antenna, together with its small number of segments, further isolates this species from any described forms. Until additional material showing the mandibles, eyes, and venation has been found, the relationship of this fossil must remain obscure.

Dolichoderinae

Aneuretini

Of the many interesting ants in the Florissant shales, one of the most peculiar and certainly the least expected is a species belonging to the Aneuretini. At the present time this tribe contains one living genus, *Aneuretus* Emery, and two extinct genera in the Baltic amber, *Para-*

neuretus Wheeler and *Protaneuretus* Wheeler. Only two species of the living genus are known (*A. simoni* Emery and *A. butteli* Forel), both of which are confined to Ceylon. The significance of the amber genera was interpreted by Wheeler (1914) as follows: "The occurrence of the two genera *Paraneuretus* and *Protaneuretus* in the Baltic amber is of considerable interest on account of their close relationship to the living genus *Aneuretus*, which is regarded as a kind of connecting link between the subfamilies *Ponerinae* and *Dolichoderinae*. The amber species are in certain respects even more primitive and generalized and are of a larger size than the single known species of *Aneuretus*. They show that the tribe Aneuretini was long ago represented by several and peculiar genera, of which only one has survived the Tertiary." The discovery of this Florissant species, representing another genus close to *Paraneuretus*, supports the conclusion that the tribe was larger and more widely distributed during the Tertiary than it is at present.

Mianeuretus, gen. nov.

Female.— Moderate size; head distinctly longer than broad, rounded, slightly narrowed anteriorly; sides convex; eyes large, ocelli present; mandibles triangular, with blunt teeth; antennae slender, with eleven subequal segments; thorax about as broad as the head; petiole much longer than broad, surmounted posteriorly by a small node; gaster of moderate size. (Venation unknown.)

Genotype.— *M. mirabilis*, sp. nov.

Mianeuretus mirabilis, sp. nov.

Plate 3, fig. 5. Plate 10, fig. 1

Female (deälated).— Length, 9.0 mm. Head rather small, posterior margin straight, posterior angles broadly rounded; clypeus and front of head striated; mandibles small, with three large, bluntly rounded teeth on the inner margin; scapes not quite reaching the posterior margin of the head; funiculus moderately long, segments 3–11 somewhat longer than broad, 2 and 12 twice as long as broad; thorax about as broad as the head and a little longer; gaster about two and one-half times as long as the head, and twice as wide. Length of head, 1.6 mm.; scape, 1.4 mm.; funiculus, 2.0 mm.; thorax, 2.0 mm.; gaster, 4.2 mm. Width of head, 1.2 mm.; thorax, 1.2 mm.; gaster, 2.4 mm.

Holotype.— No. 2797, M. C. Z. (S. H. Scudder).

The single specimen of this species is so perfectly preserved that all

the details necessary for its proper classification are known. The gaster is the only part which shows much distortion, and this has been pressed so flat that the first segment is broken away from the second segment, producing much the appearance of a ponerine.

Dolichoderini

Dolichoderus (Hypoclinea) Lund

This genus has turned up regularly in the larger fossil ant deposits. Seven species have been recognized in the Baltic amber, two in the Radoboj beds, and three are described below from Florissant. This wide distribution in the Tertiary is only to be expected in view of the large area inhabited by the genus at the present time. It is interesting to observe, however, that although *Dolichoderus* is well represented in the eastern United States, no living species has been taken in the western part. The presence of these species in the Florissant shales shows that during the Miocene at least the genus extended much further westward than at the present time.

Dolichoderus antiquus, sp. nov.

Plate **4**, fig. 6. Plate **9**, fig. 1. Plate **10**, fig. 2

Female.— Length, 6.5 mm. Moderately robust; head a little longer than broad, posterior margin only slightly concaved, posterior angles rounded, sides convex; mandibles large, with curved outer margins; scapes rather short, not quite reaching the posterior margin of the head; funicular segments 2–10 a little longer than broad, segments 1, 11 nearly twice as long as broad; eyes oval, of moderate size, situated at the middle of the sides of the head; thorax a little longer than the head and nearly as wide; epinotum concaved posteriorly, the dorsal part projecting over the petiole; scale of the petiole obtuse, nearly cuneiform; gaster about twice as long as the head, and about one and one-half times as broad; forewings short, with two cubital cells. The dorsal part of the head, epinotum and the sides of the rest of the thorax are marked with coarse rugose reticulations. Length of head, 1.5 mm.; scape, 1.0 mm.; funiculus, 1.5 mm.; thorax, 1.9 mm.; gaster, 3.1 mm.; forewing, 4.0 mm. Width of head, 1.2 mm.; thorax, 1.1 mm.; gaster, 1.9 mm.

Holotype.— No. 2798, M. C. Z. (S. H. Scudder).

Paratypes.— No. 10,000, Peabody Museum; no. 7824, Princeton Uni-

versity; no. (2), British Museum; no. 1700a, University of Colorado; no. 2, Wickham coll.; no. 22,973, A. M. N. H.

The holotype specimen is a dorsal view of the insect with the wings spread. The ocelli, although probably present in the species, are not visible because of the sculpturing on the head. The venation of the forewing is variable with respect to the shape of the discoidal cell and the point of divergence of the first intercubitus.

The worker of this species is represented, I believe, by two specimens of fair preservation. One of these is a lateral view of the thorax and gaster, and a dorsal view of the head; the other (ergatotype) is entirely a lateral specimen. No sculpturing is discernible but I infer that this is due to insufficient preservation. The head, thorax, and petiole are identical with those of the above female. The measurements of the ergatotype are as follows: length of specimen, 6.0 mm.; length of head, 1.3 mm.; thorax, 1.7 mm.; gaster, 3.0 mm. Width of head, 0.9 mm.

Ergatotype.— No. 2803, M. C. Z. (S. H. Scudder).

Paratype.— No. 10,002, Peabody Museum.

Dolichoderus rohweri, sp. nov.

Plate **4**, fig. 1. Plate **9**, fig. 7. Plate **10**, fig. 3

Female.— Length, 5.3 mm. Moderately slender; head somewhat longer than broad, posterior margin only slightly concaved, posterior angles rounded; lateral margins curved; clypeus probably quite large; scape short, not reaching the posterior margin of the head; funicular segments 2–10 about as long as broad, the first and last somewhat longer; eyes oval, of moderate size, situated at the middle of the sides of the head; thorax about as broad as the head; epinotum only slightly concaved posteriorly, and not extending backward far enough to project over the petiole; scale of the petiole with its anterior face nearly vertical and the posterior face at about a 45-degree angle; gaster about two and one-half times the length of the head. Clypeus striated, the entire head and pronotum finely reticulate, the sculpturing on the epinotum coarser; posterior face of the scale of the petiole with a few longitudinal striations. Length of head, 1.2 mm.; scape, 0.6 mm.; funiculus, 0.9 mm.; thorax, 1.7 mm.; gaster, 2.4 mm. Width of head, 0.85 mm.

Holotype.— No. 2801, M. C. Z. (S. H. Scudder).

Paratypes.— No. 10,001, Peabody Museum; no. 2825, Princeton

University; no. 17,003a, University of Colorado; no. 22,974, A. M. N. H. no. (3), British Museum.

The holotype is a lateral view of the thorax and abdomen, but a dorsal view of the head. All the paratypes are lateral specimens. This female is readily distinguished from the preceding by its smaller size, finer sculpturing, structure of the epinotum and the longer petiole.

The worker of this ant appears to be represented by a single specimen, presenting a lateral view of the thorax and gaster; the head is bent under the thorax and is consequently rather obscure. There is no doubt, however, that this worker belongs to *Dolichoderus,* and since it is about the correct size and has sculpturing similar to that of the above female, it can be assigned to this species without much chance of error. The recognizable characters are as follows: length, 3.9 mm.; the last two or three funicular segments somewhat larger than the others; eyes nearly round, small; length of thorax, 1.8 mm.; meso-epinotal suture very distinct; posterior face of the epinotum more deeply concaved than in the female; length of gaster, 2.0 mm.

Ergatotype.— No. 2802a-b (S. H. Scudder).

Tapinomini

Protazteca, gen. nov.

Allied to *Azteca.*

Female.— Head quadrate or subquadrate; mandibles large, triangular, with a distinct terminal tooth; anterior margin of clypeus straight; antennae 12-segmented, short, the scapes not reaching the posterior margin of the head, inserted close together near the clypeus; eyes oval, rather small, situated on the sides of the anterior half of the head; posterior face of the epinotum rounded; petiole rather small, gaster of moderate size; forewing with two closed cubital cells.

Male.— Only a little smaller than the female; head triangular; antennae 11-segmented; scape about as long as first funicular segments, as in *Azteca;* thorax and gaster relatively large; venation as in the female.

Worker.— Much smaller than the female, but otherwise similar to it.

Genotype.— *Protazteca elongata,* sp. nov.

Inasmuch as the extant genus *Azteca* is now confined to parts of South and Central America, the occurrence of this closely related genus in the Colorado Miocene is unusually interesting, especially since the female of *P. elongata* is one of the most numerous ants of the Florissant shales. *Azteca* and *Protazteca* are readily distinguished by several

characters: (1) the eyes in *Protazteca* are smaller and situated more posteriorly than in *Azteca;* (2) the scale of the petiole is more strongly inclined in *Azteca;* and (3) the forewings of *Protazteca* have two cubital cells, but those of *Azteca* have only one. This last distinction may be considered as indicative of the more primitive nature of the Miocene forms.

In 1906 Cockerell described a female ant from Florissant as *Ponera hendersoni,* which he placed in *Ponera* because of its similarity to the figure of *Ponera coarctata* Latr. in one of Wheeler's papers. His description of this ant is based almost entirely upon details of wing venation, so that it is impossible to recognize the species from the characters mentioned, and unfortunately the single specimen which Cockerell studied was lost shortly after the description was prepared. Wheeler subsequently pointed out (1910) that this ant could not be a true *Ponera* because of its large size. In 1927 Cockerell found three additional specimens (Sternberg collection, at the British Museum) which he believes to be this species, from a comparison with the same figure of *Ponera coarctata.* He placed the ant this time in *Euponera,* but did not designate any of these additional specimens as neotypes. Professor Cockerell kindly retained one of these newly acquired fossils so that I was able to examine it on my visit to Boulder in 1927. The specimen he showed me turned out to be a poorly preserved individual of the species which I am describing below as *Protazteca elongata.* At first I believed that the best procedure to clear up the difficulty would be to designate one of these new specimens of Cockerell's as the neotype of *Protazteca hendersoni* (= *Euponera hendersoni*). At that time my study of the Florissant ants was not completed, and after further examination of the material at hand I found two other species of *Protazteca,* both of which had as much and even more the appearance of *Ponera coarctata* (with which Cockerell made his original comparison) as *Protazteca elongata.* This accordingly brought up the question of the accuracy of Cockerell's determination of the specimens in the Sternberg collection, since twenty years had passed from the time of his description and the loss of the type, and especially since his description would apply to any one of three species of ants in the Florissant beds. In consideration of all the complications of the situation, it seems best to describe all three species of *Protazteca* as new, and to disregard the name *Euponera hendersoni,* until the type is found.

Protazteca elongata, sp. nov.

Plate 2, fig. 3. Plate 8, fig. 5. Plate 9, fig. 3. Plate 10, fig. 4

Female.— Length, 9.0 to 11.0 mm. Slender and elongate; head about twice as long as broad; posterior margin of head distinctly concaved, lateral margins straight and parallel; mandibles prominent, with a large terminal tooth and a number of irregular marginal teeth; posterior margin of clypeus prolonged backward at the middle; first three funicular segments twice as long as broad, the remaining segments about as long as broad; eyes elongate-oval; thorax about as long and as broad as the head; anterior face of the scale of the petiole slightly concaved, the posterior face convex; gaster slender, nearly twice as long as wide, and about twice as long as the head; forewing extending just a little beyond the end of the gaster. Length of head, 2.4 to 2.6 mm.; scape, 1.0 mm.; funiculus, 1.9 mm.; thorax, 2.7 to 3.0 mm.; gaster, 5.1 to 5.3 mm. Width of head and thorax, 1.3 to 1.5 mm.; gaster, 1.9 mm.

Holotype.— No. 2804a-b, M. C. Z. (S. H. Scudder).

Paratypes (♀).— Nos. 2805–2815, M. C. Z.; nos. 10,003–10,007, Peabody Museum; no. 7826, Princeton University; nos. 17,002, 17,003, University of Colorado; no. 78,791, U. S. N. M.; no. 22,978, A. M. N. H.; no. (4), British Museum; no.(1), Dublin Museum; nos. 8–15, Wickham collection; no. 13, Carnegie Museum.

The worker is much smaller than the female, but structurally similar, except that the head is not so elongate. Length, 5.0–7.0 mm. Length of head, 1.5 mm.; scape, 0.9 mm.; funiculus, 1.8 mm.; thorax, 2.1 mm.; gaster, 2.1 mm. Width of head, 0.9 mm.; thorax, 1.0 mm.; gaster, 1.8 mm.

Ergatotype.— No. 2816, M. C. Z. (S. H. Scudder).

Paratypes (☿).— No. 10,008, Peabody Museum; no. 22,979, A. M. N. H.; no. 78,791, U. S. N. M.

The male is a little smaller than the female, and moderately robust; head small, narrow, but quite long; eyes large, nearly round; scape short; the funicular segments a little longer than broad; thorax and abdomen stout; venation as in the queen. Length, 6.0 mm.; head, 1.5 mm.; scape, 0.5 mm.; funiculus, 1.3 mm.; thorax, 2.1 mm.; gaster, 3.0 mm.; forewing, 5.4 mm. Width of head, 7.0 mm.; thorax, 1.0 mm.; gaster, 1.8 mm.

Allotype (♀).— No. 2818, M. C. Z. (S. H. Scudder).

Paratypes.— Nos. 2819–2822, M. C. Z.; no. 10,009, Peabody Museum;

no. 17,001c, University of Colorado; no. 7827, Princeton University; no. 78,791, U. S. N. M.; no. 22,980, A. M. N. H.; no. (5), British Museum; no. (2), Dublin Museum; no. 16, Wickham collection; no. 14, Carnegie Museum.

As mentioned above, this species is one of the commonest of the Florissant ants. In the collections at my disposal I have found a total of about 800 females, 700 males, and 8 workers. With respect to this great abundance of individuals it is interesting to note that the males and females (probably also the neuters) are very variable in size. This variation is frequently so extreme that anyone who might compare isolated large and small females would readily consider the two as belonging to different species. Such, in fact, was my assumption when I began to study this species, but after several hundred specimens had been examined, I was able to recognize a complete series of specimens ranging in size from 9.0 to 11.0 mm. The holotype is one of the smaller specimens, but many of the paratypes are members of the larger end of the series.

The excessively slender head of the female of this species is indicative of the habits of the ant. A similarly elongate head occurs in recent species of several unrelated genera, i. e., *Azteca longiceps* Emery, *Pseudomyrma filiformis* Fab., and *Camponotus* (*Myrmostenus*) *mirabilis* Emery. Since all these ants live in hollow twigs, the exaggerated tenuity being an adaptation for this mode of life, we may reasonably assume that *P. elongata* had similar habits.

Protazteca quadrata, sp. nov.

Plate 3, fig. 1. Plate 6, fig. 7. Plate 10, fig. 5

Female.— Length, 11.0 to 12.0 mm. Robust; head very large, about one and one-half times as long as broad; posterior margin of the head straight; lateral margins also straight and parallel; mandibles very large, with six sharp triangular teeth; the first two funicular segments at least twice as long as broad, the other segments about as long as broad; eyes situated a little anterior of the middle of the head; thorax narrower, and only a little longer than the head; scale of petiole low, truncate; gaster large, about twice as long and nearly twice as wide as the head. Length of head, 3.5 mm.; scape, 1.8 mm.; funiculus, 2.2 mm.; thorax, 3.6 mm.; gaster, 5.7 mm.; forewing, 7.0 mm. Width of head, 2.2 mm.; thorax, 1.8 mm.; gaster, 4.0 mm.

Holotype.— No. 2823a-b, M. C. Z. (S. H. Scudder).

Paratypes.— No. 2824, 2825, M. C. Z.; no. 10,010, Peabody Museum;

no. 7831, Princeton University; no. 17,002a, University of Colorado; no. 78,792, U. S. N. M.; nos. 22,962–63, A. M. N. H.; no. 17–19, Wickham collection; no. 15, Carnegie Museum.

The holotype specimen is one of the most perfectly preserved ants in the Florissant collection. The queen of this species can readily be distinguished from that of the preceding by the proportionally shorter and broader head, larger mandibles, and truncate scale of the petiole. The worker is represented by two specimens, one of which is nearly as splendidly preserved as the female. The head is about as large, comparatively, as that of the queen, but it is not as markedly quadrate, and the mandibles are less prominent. Measurements: length, 7.5 mm.; length of head, 2.1 mm.; scape, 1.2 mm.; funiculus, 1.8 mm.; thorax, 2.4 mm.; gaster, 3.6 mm. Width of head, 1.3 mm.; thorax, 1.0 mm.; gaster, 2.4 mm.

Ergatotype.— No. 2826, M. C. Z. (S. H. Scudder).

Paratype.— No. 10,011, Peabody Museum.

Protazteca capitata, sp. nov.

Plate 3, fig. 3. Plate 9, fig. 10

Female.— Length, 9.5 mm. Moderately robust; head very large, quadrate, posterior margin straight, posterior angles broadly rounded; mandibles of moderate size; all funicular segments a little longer than broad; eyes situated on the sides of the head, very near the middle line; thorax relatively slender, a little longer than the head, but not nearly as wide; gaster short, not quite twice as long or as wide as the head. Length of head, 2.4 mm.; scape, 1.3 mm.; funiculus, 1.9 mm.; thorax, 3.0 mm.; gaster, 4.5 mm. Width of head, 1.8 mm.; thorax, 1.4 mm.; gaster, 2.7 mm.

Holotype.— No. 2827a-b, M. C. Z. (S. H. Scudder).

Paratypes.— No. 10,012, Peabody Museum; no. 7832, Princeton Museum; no. 17,004a, University of Colorado; no. 78,793, U. S. N. M.; no. 22,961, A. M. N. H.; no. 20, Wickham collection; no. 16, Carnegie Museum.

There is a single obscure worker in the Scudder collection which I consider to belong to this species. The antennae, mandibles, and eyes are not preserved, but the shape of the head is so similar to that of the above female that I feel justified in this conclusion. The habitus of the worker can be seen in the photograph, and since no details of structure are preserved, I can only describe the insect by the following measure-

ments: length, 6.0 mm. Length of head, 1.5 mm.; thorax, 2.0 mm.; gaster, 2.1 mm. Width of head, 1.2 mm.; thorax, 0.4 mm.; gaster, 1.8 mm.

Ergatotype.— No. 2828, M. C. Z. (S. H. Scudder).

Liometopum Mayr.

The four living species which comprise this genus inhabit very disconnected regions. *L. apiculatum* Mayr occurs in Mexico, Arizona, New Mexico, and Colorado; *L. occidentale* Emery, in California and Oregon; *L. lindgreeni* Forel, in Burma and Assam; and *L. microcephalum* (Panzer), in southern Europe and Asia Minor. The Baltic amber contains one species, *L. oligocenicum* Wheeler, and the Radoboj beds another, *L. antiquum* Mayr. The two Florissant forms described below increase the number of extinct species to four, which equals that of those now living. The obvious conclusion is that the extant species are only a small remnant of a large series of forms which comprised the genus during the mid-Tertiary.

Liometopum miocenicum, sp. nov.

Plate 3, fig. 6. Plate 8, fig. 3. Plate 9, fig. 8. Plate 10, fig. 8. Plate 11, fig. 7

Female.— Length, 12.0 to 13.0 mm. Robust; head triangular, a little longer than its greatest width, posterior margin straight, lateral margins curved; mandibles large, triangular, with six or seven irregular teeth; scapes very short, not reaching the posterior margin of the head; first three funicular segments a little longer than broad, the remaining segments about as long as broad; eyes oval, of moderate size; thorax a little longer than the head, and nearly as broad; scale of petiole narrow, its anterior face vertical, and its posterior face inclined at an angle of about 60 degrees; gaster large, about three times as long as the head, and about twice as wide. Length of head, 3.8 mm.; scape, 2.0 mm.; funiculus, 3.5 mm.; thorax, 5.0 mm.; gaster, 10.5 mm.; forewing, 9.0 mm. Width of head, 3.3 mm.; thorax, 3.5 mm.; gaster, 7.0 mm.

Holotype.— No. 2829, M. C. Z. (H. F. Wickham).

Paratypes.— Nos. 2830–2840, M. C. Z.; nos. 10,013–10,015, Peabody Museum; nos. 7833–7837, Princeton University; no. 17,005a, b, c, University of Colorado; no. 78,794, U. S. N. M.; nos. 22,954–55, A. M. N. H.; no. (7–8), British Museum; no. (3–4), Dublin Museum; nos. 21–28, Wickham collection; no. 17, Carnegie Museum.

By far the majority of the females have the head flattened so that it is more nearly round than triangular, but the best specimens (i.e., those showing the least amount of distortion) have the head triangular, as shown in the drawing.

Male.— Somewhat smaller than the female; head very small in proportion to the rest of the insect; genitalia large, as in the members of this genus. Length, 9.5 mm. Length of head, 1.5 mm.; antennae, 2.4 mm.; thorax, 2.6 mm.; gaster, 4.9 mm.; forewing, 8.0 mm. Width of head, 1.2 mm.; thorax, 1.8 mm.; gaster, 3.0 mm.

Allotype (♂).— No. 2840, M. C. Z. (H. F. Wickham).

Paratypes (♂).— Nos. 2841–2849, M. C. Z.; no. 10,016, Peabody Museum; no. 7828, Princeton University; no. 17,005d, University of Colorado; no. 78,794, U. S. N. M.; nos. 22,956–57, A. M. N. H.; no. (9), British Museum; no. (5), Dublin Museum; nos. 29–30, Wickham collection; no. 18, Carnegie Museum.

Worker.— Much smaller than female; head a little longer than broad, more or less cordate; scape short; thorax not quite so long or so wide as the head; gaster about twice as long and one and one-half times as wide as the head. Length, 6.0 mm. Length of head, 2.7 mm.; thorax, 2.4 mm.; gaster, 5.8 mm. Width of head, 2.2 mm.; thorax, 1.3 mm.; gaster, 3.0 mm.

Ergatotype.— No. 2850, M. C. Z. (S. H. Scudder).

Although I have seen a number of other workers apparently belonging to this species, I have not designated them as paratypes, since none of them show the details which are necessary for satisfactory determination. This species stands a close second to *Protazteca elongata* as regards abundance.

Liometopum scudderi, sp. nov.

Plate **4**, fig. 4. Plate **9**, fig. 4

Female.— Length, 8.0 mm. Robust; head triangular, a little longer than broad; posterior margin and angles rounded, lateral margins only slightly curved; mandibles of moderate size, with three or four prominent teeth; anterior margin of clypeus straight, posterior margin prolonged behind even more than in *L. miocenicum;* scapes not quite reaching the posterior margin of the head; funicular segments about as long as broad; eyes small, oval; thorax about one and one-half times as long, and about as wide as the head; gaster about three times as long as the head, and a little more than twice as wide; forewing short, not reaching the end of the gaster. Length of head, 1.5 mm.; scape, 0.9

mm.; funiculus, 1.5 mm.; thorax, 2.0 mm.; gaster, 5.0 mm.; forewing, 5.1 mm. Width of head, 1.4 mm.; thorax, 1.4 mm.; gaster, 2.4 mm.

Holotype.— No. 2851, M. C. Z. (S. H. Scudder).

Paratypes (♀).— Nos. 2852–2854, M. C. Z.; no. 10,017, Peabody Museum; no. 17,006a, University of Colorado; no. 78,795, U. S. N. M.; no. 22,959, A. M. N. H.; no. 2, Carnegie Museum.

The worker of this species appears to be represented by a few, rather poorly preserved individuals. Although none of them show details of structure, they have a habitus much like that of the worker of the preceding species but are smaller. Length, 5.0 mm. Length of head, 1.2 mm.; scape, 0.9 mm.; funiculus, 1.5 mm.; thorax, 1.5 mm.; gaster, 2.4 mm. Width of head and thorax, 0.9 mm.; gaster, 1.8 mm.

Ergatotype.— No. 2855, M. C. Z. (S. H. Scudder).

The female of this species is very similar to that of *L. miocenicum*, but can be distinguished from it by its smaller size and proportionally longer scapes.

Elaeomyrmex, gen. nov.

Female.— Head much longer than broad, narrowed anteriorly, posterior margin straight or slightly rounded, posterior angles broadly rounded, lateral margins nearly straight; mandibles prominent, triangular, with a large terminal tooth and five or six smaller teeth on the inner margin; clypeus large, anterior margin apparently straight, posterior margin with a prominent, median prolongation; entire clypeus with a series of fine striations which converge anteriorly; scapes of moderate size, not quite reaching the anterior margin of the head; eyes oval, of moderate size, situated at about the middle of the sides of the head; ocelli well developed; thorax rather long, slender; petiole small, the scale flattened, highest anteriorly; gaster slender; forewing with two closed cubital cells. The whole insect has a peculiar greasy appearance, unlike that of any other of the Florissant ants.

Worker.— Much smaller than the female but essentially the same in structure, except for somewhat smaller eyes. Clypeus striated as in the female.

Genotype.— *Elaeomyrmex gracilis*, sp. nov.

This genus has rather obscure affinities, but it probably belongs to Tapinomini, not very remote from *Iridomyrmex*.

Elaeomyrmex gracilis, sp. nov.

Plate 3, fig. 7. Plate 6, fig. 2. Plate 11, fig. 1

Female.— Length, 9.0 to 10.0 mm. Moderately slender; head rather long, oval, about one and one-half times as long as broad, posterior

margin rounded; first two and last funicular segments nearly twice as long as broad, the others only a little longer than broad; thorax not quite one and one-half times as long as the head, and about as wide as the head; scale of the petiole with several coarse, longitudinal corrugations at the base of the posterior face; gaster more than twice as long as the head, but not quite twice as wide; forewing short, not reaching the end of the gaster. Length of head, 2.1 mm.; scape, 1.5 mm.; funiculus, 2.3 mm.; thorax, 2.7 mm.; gaster, 4.2–4.8 mm.; forewing, 6.0 mm. Width of head, 1.7 mm.; thorax, 1.4 mm.; gaster, 2.4 mm.

Holotype.— No. 2863, M. C. Z. (S. H. Scudder).

Paratypes (♀).— Nos. 2864–2865, M. C. Z.; no. 10,021, Peabody Museum; no. 17,009a, University of Colorado; no. 78,797, U. S. N. M.

Worker.— For specific characters the measurements only can be given, but these, in addition to the description under the genus, will suffice to identify this caste. Length, 7.0 mm. Length of head, 1.8 mm.; scape, 1.2 mm.; funiculus, 1.8 mm.; thorax, 2.1 mm.; gaster, 2.9 mm. Width of head, 1.3 mm.; thorax, 1.2 mm.; gaster, 2.4 mm.

Ergatotype.— No. 2866, M. C. Z. (H. F. Wickham).

Paratypes (☿).— No. 10,021, Peabody Museum; no. 17,009b, University of Colorado; no. 22,969, A. M. N. H.

Both queens and workers of this species are fairly common in the Florissant shales. Including the types mentioned above, I have seen forty-two females and eight workers.

Elaeomyrmex coloradensis, sp. nov.

Plate 3, fig. 2. Plate 9, fig. 2

Female.— Length, 8.0 mm. Moderately slender; head only a little longer than broad, with less rounded posterior angles than in the preceding species; mandibles of moderate size; scapes very nearly reaching the posterior margin of the head; the first two funicular segments, as well as the last, about twice as long as broad, the other segments very nearly as broad as long; thorax twice as long and about as wide as the head; petiole of moderate size, apparently without corrugations; gaster large, not quite three times as long as the head, its greatest width twice that of the head; forewing short, just reaching the end of the gaster. Length of head, 1.5 mm.; scape, 1.2 mm.; funiculus, 1.8 mm.; thorax, 2.7 mm.; gaster, 4.0 mm.; forewing, 6.0 mm. Width of head, 1.3 mm.; thorax, 1.3 mm.; gaster, 2.4 mm.

Holotype.— No. 2867, M. C. Z. (F. M. Carpenter).

Paratypes (♀).— No. 2868, 2869, M. C. Z.; no. 10,022, Peabody

Museum; no. 17,010a, University of Colorado; no. 78,798, U. S. N. M.; no. 6, Carnegie Museum.

The worker of this species appears to be represented by three specimens, which show no characters besides those given under the genus. Length, 6.0 mm. Length of head, 1.5; scape, 1.2; funiculus, 1.7 mm.; thorax, 2.1 mm.; gaster, 2.7 mm. Width of head, 1.0 mm.; thorax, 0.9 mm.; gaster, 1.8 mm.

Ergatotype.— No. 2870, M. C. Z. (S. H. Scudder).

Paratypes (♀).— No. 2871, M. C. Z.; no. 10,023, Peabody Museum.

The female of this species, which is very close to *E. gracilis* but much less common (29 specimens), can be distinguished from that of the latter by its shorter head, relatively longer thorax, and probably also by the lack of corrugations on the scale of the petiole. The worker can be separated from that of the preceding species only with considerable difficulty, but its head is also a little shorter.

Iridomyrmex Mayr

This genus is now widely distributed over the tropical and subtropical regions of the world, reaching its maximum development in Australia. Only one species, *I. analis* E. Andre, is native to North America. As one would naturally expect from the primitive distribution of recent species, the genus is well represented in Tertiary deposits, five species having been found in the Baltic amber, and the two following in the Florissant beds. Our lack of knowledge of the details of the mandibles and clypeus of the Florissant species might seem to throw some doubt on their generic position, but both are obviously dolichoderines with affinities closer to *Iridomyrmex* than any other genus.

Iridomyrmex florissantius, sp. nov.

Plate 2, fig. 4. Plate 10, fig. 7

Female.— Length, 6.0 mm. Moderately robust; head about one and one-half times as long as broad; posterior margin slightly curved, posterior angles broadly rounded, lateral margins slightly convex; mandibles small; scape reaching the posterior margin of the head; first funicular segment about twice as long as broad, the other segments as broad as long; thorax a little longer than the head and about as wide; epinotum rounded; petiole small, the scale inclined slightly forward; gaster about two and one-half times as long as the head, and twice as

wide; forewing with two cubital cells. Length of head, 1.2 mm.; scape, 0.7 mm.; funiculus, 0.9 mm.; thorax, 1.5 mm.; gaster, 3.0 mm. Width of head, 0.9 mm.; thorax, 0.9 mm.; gaster, 1.8 mm.

Holotype.— No. 2872, M. C. Z. (S. H. Scudder).

Paratypes (♀).— Nos. 2873–2875, M. C. Z.; no. 10,024, Peabody Museum; no. 17,011a, University of Colorado; no. 22,965, A. M. N. H.; no. 7, Carnegie Museum.

This female is not at all rare; I have seen 34 specimens. The worker is probably present among the several which I have not been able to determine.

Iridomyrmex obscurans, sp. nov.

Female.— Length, 8.0–9.0 mm. Moderately robust; head a little longer than broad, posterior margin quite straight, lateral margins distinctly curved; mandibles prominent; scape reaching the posterior margin of the head; first funicular segment about twice as long as broad, the others as broad as long; eye small; thorax a little longer than the head and about as wide; gaster of moderate size, a little more than twice as long as the head, and one and one-half times as broad; forewings with two cubital cells.

Holotype.— No. 78,799, U. S. N. M. (Lacoe collection).

This species is one of the most obscure of the Florissant ants, since nothing but the more general features are known. I have described it because the presence of 26 specimens in the material before me shows that it is fairly common in the deposit. Its habitus is so similar to that of the previous species that a figure seems unnecessary. It may be distinguished from *I. florissantius* by its larger size and more robust mandibles.

Miomyrmicini, tribus nov.

Miomyrmex, gen. nov.

Female.— Head of moderate size, longer than broad; posterior and lateral margins quite straight, sides nearly parallel; mandibles prominent, deeply corrugated, with four or five blunt teeth on the inner margin; anterior margin of clypeus prolonged, but abruptly truncate; posterior margin slightly prolonged backward; eyes large, situated rather high up on the sides, at about the middle line of the head; ocelli small, close together; antennae inserted close to the clypeus, exceedingly short, 12-segmented, the scapes not over one-half the length of the head, the funiculus only a little longer than the scape; epinotum

prolonged backward slightly over the petiole; scale of petiole large, more or less erect, nearly cuneiform; forewing with a closed cubital cell and a discoidal cell.

Male.— Nearly as large as the female; head small, triangular, about as broad as long; eyes very large, projecting, situated in the posterior half of the head; ocelli large, close together; mandibles small, narrow; antennae very short, composed of thirteen segments, the scape about as long as the first three segments; venation as in the female.

Worker.— Smaller than the female; head large, oval; eyes small; mandibles prominent; antennae like those of the female but with a thicker funiculus.

Genotype.— *Formica impactus* Ckll.

The affinities of *Miomyrmex* are rather obscure. In his original description Cockerell placed the genotype species in the Formicinae, as a true *Formica*, apparently because the venation of this form (one closed cubital cell and a discoidal) was similar to that of *Formica*. This type of venation, however, is not only found in other genera of Formicines, but also in many dolichoderines, including *Azteca* and *Iridomyrmex*. The venation, at any rate, is the only character which *Miomyrmex* and *Formica* have in common. The habitus of this peculiar extinct genus is much more suggestive of a dolichoderine than a formicine, and although it would be necessary to determine the nature of the cloacal opening in order to settle the matter, we may safely consider that *Miomyrmex* belongs to the former subfamily. There is, however, no known genus of the Dolichoderinae with such abbreviated antennae, and for this reason *Miomyrmex* requires a new tribe.

Miomyrmex impactus (Ckll.)

Plate **2**, fig. 7. Plate **7**, fig. 1, 2. Plate **10**, fig. 6, 11

Formica impactus, Cockerell, T. D. A., 1927. Ann. Mag. Nat. Hist. (9), **19**, p. 165.

Female.— Length, 16–17 mm. Robust; head rather long, subquadrate; mandibles with five blunt teeth; clypeus and anterior half of the head with a series of fine parallel striations; scapes slender and abbreviated, not reaching the posterior margin of the eyes; funicular segments nearly as broad as long, the terminal joints slightly larger than the rest; ocelli very close together; thorax a little longer than the head and about as broad; scale of the petiole with the anterior face vertical, posterior face inclined and slightly convex; gaster about two and one-half times as long as the head, and about twice as wide; fore-

wing short, not reaching the end of the gaster. Length of head, 3.3 mm.; scape, 1.2 mm.; funiculus, 1.5 mm.; thorax, 4.2 mm.; gaster, 8.5 mm.; forewing, 11.0 mm. Width of head, 2.4 mm.; thorax, 2.7 mm.; gaster, 4.5 mm.

Holotype.— At British Museum.

Homotypes.— Nos. 2856–58, M. C. Z.; no. 10,018, Peabody Museum; no. 7840, 7841, Princeton University; no. 17,007a, University of Colorado; no. 98,796, U. S. N. M.; no. 34, Wickham collection; no. 3, Carnegie Museum; no. 22,972, A. M. N. H.

Cockerell's description of this female, based upon a single specimen in the Sternberg collection, consists mainly of minute venational details, which, as I have shown above, are entirely useless for determination. He also assigned the following structural characters: "Length nearly 17 mm., anterior wing about 11 mm. Robust, dark brown, the abdomen sutures broadly hyaline; head rather regularly oval, not broadened behind; mandibles massive, minutely denticulate; lower margin of clypeus entire, gently arched; wings hyaline, with dark brown stigma and brown veins." As shown above the color of the Florissant ants cannot be used for specific determination, since it varies for the individual, and the hyaline nature of the abdominal sutures as well as the brown color of the veins and stigma are characters which apply to nearly every Florissant ant. Not being able to recognize the species from Cockerell's description, I examined his type just before it was sent to the British Museum with the rest of the Sternberg collection. My above description is based upon this type, as well as 37 additional specimens in the various collections loaned to me. It should be observed that I described the mandibles as having five blunt teeth, although Cockerell stated that they were "minutely denticulate." I was unable to find any mandibular teeth on the type specimen and believe that Cockerell mistook for teeth the irregularities of the somewhat fractured mandibles. A number of specimens collected by Scudder show these blunt teeth very clearly.

The male is represented by a single specimen showing merely the general characters and since it has been discussed under the genus, only the dimensions can be added. Length, 13.5 mm.; length of head, 2.1 mm.; antennae, 2.5 mm.; thorax, 4.2 mm.; gaster, 7.2 mm.; forewing, 8.0 mm. Width of head, 2.1 mm.; thorax, 4.2 mm.

Allotype.— No. 2859a-b, M. C. Z. (S. H. Scudder).

The worker is represented by a single specimen collected by Scudder, but is so much smaller in size than the above female that it might possibly belong to the next species. The head has more rounded pos-

terior angles, and convex sides; the eyes are elongate, situated on the sides of the head, at about the middle line; the antenna is as relatively short as that of the female, but has a much heavier funiculus. Length, 7.5 mm.; length of head, 2.4 mm.; scape, 0.4 mm.; funiculus, 0.5 mm.; thorax, 2.4 mm.; gaster, 3.0 mm. Width of head, 1.8 mm.; thorax, 1.2 mm.; gaster, 1.8 mm.

Ergatotype.— No. 2860, M. C. Z. (S. H. Scudder).

The female of *M. impactus* (Ckll.) is the largest of any of the Florissant ants. This feature, together with the striated head and especially the short antennae, makes the species readily recognizable.

Miomyrmex striatus, sp. nov.

Plate 8, fig. 6. Plate 10, fig. 9

Female.— Length, 10.5 mm. Moderately robust; head much longer than broad, subquadrate, mandibles prominent, with four blunt teeth and deep corrugations; clypeus and frons finely striated; scapes very short, reaching to about the middle of the eyes; thorax about as long as the head and about as wide; gaster about two and one-half times as long as the head, and about twice as wide; forewing short; venation identical with that of the preceding species. Length of head, 2.3 mm.; scape, 0.6 mm.; funiculus, 0.9 mm.; thorax, 2.4 mm.; gaster, 6.0 mm.; forewing, 7.0 mm. Width of head, 1.7 mm.; thorax, 1.6 mm.; gaster, 3.0 mm.

Holotype.— No. 2861a-b, M. C. Z. (S. H. Scudder).

Paratype.— No. 2944a-b, M. C. Z.

The types are the only specimens of the female which I have been able to find. Fortunately these are very well preserved in most respects, and appear to be nearly identical with the foregoing species, except that they are only one-half as large. The main structural difference is the possession of four mandibular teeth, instead of five, as in *M. impactus*.

Male.— Length, 9.0 mm. Scape a little longer than the first two funicular segments, which are a little longer than broad; front of head with faint longitudinal striations, posterior part of head with similar striations arranged obliquely; thorax nearly two and one-half times as long as the head and much broader; gaster about three and one-half times as long as the head, and twice as wide; forewing exceeding the end of the abdomen. Length of head, 1.5 mm.; antennae, 1.8 mm.; thorax, 3.6 mm.; gaster, 4.8 mm.; forewing, 6.0 mm. Width of head, 1.5 mm.; thorax, 2.1 mm.; gaster, 2.7 mm.

Allotype.— No. 2862, M. C. Z. (H. F. Wickham).

Paratypes (♂).—Nos. 2945–6 M. C. Z.; no. 10,019, Peabody Museum; no. 17,008a, University of Colorado; no. 4, Carnegie Museum.

Tribus incerta

Petraeomyrmex, gen. nov.

Female.— Small; head subquadrate; scapes short, thick; eyes small, situated on the sides of the head, anterior to the middle line; petiole very small; forewing with two cubital cells.

Genotype.— *P. minimus*, sp. nov.

The affinities of this genus are rather obscure, chiefly because of the lack of material showing the petiole. Additional fossils may indicate a close relationship to *Forelius*.

Petraeomyrmex minimus, sp. nov.

Plate 4, fig. 2

Female.— Length, 4.5 mm. Robust; head broad, only a little longer than wide, posterior margin concaved, posterior angles slightly rounded, lateral margins straight; scape not reaching the posterior margin of the head, funiculus also short; thorax a little longer than the head, about as wide; gaster nearly three times as long as the head, and about twice as wide. Length of head, 1.0 mm.; scape, 0.4 mm.; funiculus, 0.5 mm.; thorax, 1.3 mm.; gaster, 2.7 mm. Width of head, 0.9 mm.; thorax, 0.9 mm.; gaster, 1.8 mm.

Holotype.— No. 2943, M. C. Z. (S. H. Scudder).

Paratypes (♀).— No. 10,035, Peabody Museum; no. 17,021a, University of Colorado; no. 78,805, U. S. N. M.

This is the smallest Florissant female with two cubital cells in the forewing. It is not very common, there being only eleven specimens in the collections at hand.

Formicinae

Formicini

Formica Linné

This widely distributed genus is represented in the Tertiary by six Baltic amber species, several from the Radoboj formation, and three in the Florissant shales.

Formica robusta, sp. nov.

Plate 6, fig. 6. Plate 7, fig. 6

Female.— Length 9.0–10.0 mm. Robust; head triangular, about as long as broad, posterior margin straight, posterior angles rounded; mandibles quite large, with a prominent terminal tooth and a number of irregular smaller teeth; antennae slender, the scapes greatly exceeding the posterior margin of the head; eyes moderately large; thorax slender, nearly one and one-half times as long as the head, and a little broader; gaster about two and one-half times as long as the head, and twice as wide; forewing exceeding the end of the abdomen. Length of head, 1.5 mm.; scape, 1.5; funiculus, 2.2 mm.; thorax, 2.7 mm. gaster, 5.0 mm.; forewing, 7.8 mm. Width of head, 1.5 mm.; thorax, 1.8 mm.; gaster, 3.0 mm.

Holotype.— No. 2878, M. C. Z. (S. H. Scudder).

Paratype (♀).— Nos. 2879–2886, M. C. Z.; no. 10,025, Peabody Museum; no. 7842, Princeton University; no. 17,012a, Colorado University, no. 78,800, U. S. N. M.; no. 22,976, A. M. N. H.; no. 35, Wickham collection; no. 8, Carnegie Museum.

The heads of most of the females are much flattened and consequently more rounded than that of the holotype and some of the paratypes. The holotype specimen shows less distortion than any other, but the antennae and eyes are not preserved; these latter structures do appear in some of the paratypes (e.g., 2879). With very few exceptions the females are light brown, indicating that in all probability this was the original color of the insects. The female is the commonest of the formicines, some three hundred specimens having been recognized in the material at my disposal. A few of these fossils, which are otherwise identical with the above female, have a series of fine striations on the clypeus and part of the head. Since many living species of *Formica* (e.g., *F. truncicola*, and *F. rufa rufa*) have similar striations in the female and worker, it is very probable that all the queens of *F. robusta* would show these striations if they were sufficiently well preserved and in the proper position.

Male.— There are a number of males which appear to belong to this species. They are undoubtedly *Formica* and their size is consistent with that of the female, but as in the case of the males of most other species, only measurements can be given as specific characters. Length, 7.0 mm. Length of head, 1.2 mm.; scape, 1.5 mm.; funiculus, 2.7 mm.; thorax, 2.1 mm.; gaster, 3.6 mm.; forewing, 9.0 mm. Width of head, 1.2 mm.; thorax, 1.8 mm.; gaster, 2.1 mm.

Allotype.— No. 2887, M. C. Z. (S. H. Scudder).

Paratype (♂).— No. 2888, M. C. Z.

Formica cockerelli, sp. nov.

Plate 4, fig. 3

Female.— Length, 12.0 mm. Head nearly one and one-half times as long as broad, more or less triangular, posterior margin slightly rounded; mandibles small, teeth blunt; anterior margin of clypeus arched; antennae slender, the scapes greatly exceeding the posterior margin of the head; ocelli small, widely separated; thorax about one and one-half times as long and as broad as the head; gaster about two and one-half times as long as the head and twice as wide; head and thorax delicately striated. Length of head, 2.4 mm.; scape, 1.8 mm.; funiculus, 3.0 mm.; thorax, 3.6 mm.; gaster, 6.0 mm. Width of head, 1.8 mm.; thorax, 3.0 mm.; gaster, 3.6 mm.

Holotype.— No. 2889a-b, M. C. Z. (S. H. Scudder).

Paratypes (♀).— No. 78,806, U. S. N. M.

There are four males which I believe belong to this species: length, 9.0 mm. Length of head, 1.5 mm.; scape, 1.5 mm.; funiculus, 3.2 mm.; thorax, 3.0 mm.; gaster, 4.5 mm.; forewing, 9.0 mm. Width of head, 1.5 mm.; thorax, 10.8 mm.; gaster, 2.4 mm.

Allotype.— No. 2890, M. C. Z. (S. H. Scudder).

Paratypes (♂).— No. 10,026, Peabody Museum; no. 17,013a, University of Colorado.

This is not a common species, the types being the only specimens which I have seen. Both castes are readily distinguished from the preceding by their much larger size.

Formica grandis, sp. nov.

Plate 6, fig. 3

Female.— Length, 13.0 mm. Head large, triangular, about one and one-half times as long as broad, posterior margin straight; mandibles rather small, with a long terminal tooth; antennae very long and slender, the scape nearly as long as the head; funicular segments about twice as long as broad; thorax relatively small, not over one and one-third times as long as the head, and about as wide; gaster small, not quite twice as long as the head; forewing extending beyond the end of the gaster. Length of head, 3.0 mm.; scape, 2.7 mm.; funiculus, 3.9 mm.; thorax, 4.0 mm.; gaster, 5.5 mm.; forewing, 10.8 mm. Width of head, 2.0 mm.; thorax, 2.3 mm.; gaster, 3.6 mm.

Holotype.— No. 78,801, U. S. N. M. (Lacoe collection.)

Paratype.— No. 2891, M. C. Z.

This species, which is also very rare, is distinguished from the preceding by its much larger size, and the longer antennae. It is the largest of the Formicinae of Florissant.

Lasius Mayr

This holarctic genus is already represented in the Tertiary of the Baltic amber and the Radoboj beds; the Florissant shales contain one common species.

Lasius peritulus (Ckll.)

Plate 5, fig. 6. Plate 7, fig. 7

Tetramorium peritulum, Cockerell, T. D. A., 1927. Ann. Mag. Nat. Hist., (9), 19, p. 165.

Cockerell based this species on a fairly well-preserved male which I examined before it was sent to the British Museum. Since none of the characters given by Cockerell serve to identify the ant generically or specifically, and especially since it was not originally assigned to the proper subfamily, I have redescribed the species, mainly from the queen.

Female.— Length, 7.5–8.0 mm. Moderately robust; head triangular, small, about one and one-half times as long as its greatest width; posterior margin straight, posterior angles broadly rounded; mandibles of moderate size, with a long terminal tooth, and a number of irregular smaller teeth; antennae slender, scapes slightly exceeding the posterior margin of the head; funicular segments 2–5 about as broad as long, segments 6–12 longer than broad; eyes oval, rather small; thorax, oval, about one and one-half times as long as the head; petiole small, the node cuneiform; gaster relatively large, about three and one-half times as long as the head; forewing greatly exceeding the end of the gaster. Length of head, 1.3 mm.; scape, 0.9 mm.; funiculus, 1.3 mm.; thorax, 1.9 mm.; gaster, 4.8 mm.; forewing, 7.8 mm. Width of head, 0.9 mm.; thorax, 1.3 mm.; gaster, 4.8 mm.

Allotype (♀).— No. 2892, M. C. Z. (S. H. Scudder).

Paratypes (♀).— Nos. 2893–2895, M. C. Z.; no. 10,027, Peabody Museum; nos. 7843, 7844, Princeton University; no. 17,014a, b, University of Colorado; no. 78,802, U. S. N. M.; no. 22,982, A. M. N. H.; no. (10), British Museum; no. 9, Carnegie Museum.

Male.— Small, about one-half the size of the female; node of petiole small, cuneiform; gaster short, rounded. Length, 4.5 mm. Length of head, 0.9 mm.; scape, 0.4 mm.; funiculus, 1.2 mm.; thorax, 1.2 mm.;

gaster, 1.9 mm.; forewing, 4.3 mm. Width of head, 0.6 mm.; thorax, 0.9 mm.; gaster, 0.9 mm.

Holotype (♂).— In British Museum.

Just why Cockerell considered this male to belong to *Tetramorium* is not at all clear, for there is no possibility of its being even a myrmicine. Both castes are very abundant; I have seen over four hundred females and some thousand males, most of which are well preserved. The worker of such a common species must be present in the deposit also, but I have not been able to recognize it.

Camponotini

Camponotus Mayr

Inasmuch as this genus is cosmopolitan at the present time, its occurrence in the various Tertiary deposits is only to be expected. One species (*C. mengei* Mayr) has been found in the Baltic amber, one in the Gurnet Bay Oligocene (*C. brodei* Donisthorpe) and several in the Oeningen and Radoboj beds. Three species are represented in the Florissant shales.

Camponotus fuscipennis, sp. nov.

Plate **5**, fig. 4. Plate **11**, fig. 6

Female.— Length, 11.0 mm. Robust; head rounded, very large, nearly twice as long as broad, posterior margin straight, posterior angles slightly rounded, lateral margins convex; mandibles of moderate size, triangular, with a few small teeth; clypeus large; scapes not quite reaching the posterior margin of the head; eyes small, elongate, placed well back on the posterior half of the head; thorax about as long as the head, but not as wide; gaster about one and one-half times as long as the head, and nearly twice as broad; forewing reaching the tip of the gaster, and with a distinct brown patch around the pterostigma. Length of head, 3.0 mm.; scape, 1.5 mm.; funiculus, 2.1 mm.; thorax, 3.0 mm.; gaster, 4.8 mm.; forewing, 8.5 mm. Width of head, 1.8 mm.; thorax, 1.5 mm.; gaster, 3.0 mm.

Holotype.— No. 2897, M. C. Z. (F. M. Carpenter).

Paratypes (♀).— No. 10,029, Peabody Museum; no. 17,015a, University of Colorado.

This species, which is easily recognizable by the brown patch on the wing, is represented by only four specimens, so it is apparently very rare.

Camponotus microcephalus, sp. nov.

Plate 6, fig. 4. Plate 11, fig. 8

Female.— Length, 8.0 mm. Moderately slender; head small, elongate, about twice as long as broad, posterior margin short, nearly straight; posterior angles broadly rounded, lateral margins convex; mandibles rather large in comparison with the size of the head; scapes not reaching the posterior margin of the head; funicular segments about as long as broad; thorax a little longer than the head, and nearly twice as wide; gaster about three times as long as the head, and nearly three times as wide; wing just reaching the tip of the abdomen. Length, of head, 1.3 mm.; scape, 1.0 mm.; funiculus, 1.5 mm.; thorax, 1.8 mm.; gaster, 4.2 mm.; forewing, 5.4 mm. Width of head, 7.0 mm.; thorax, 1.5 mm.; gaster, 2.5 mm.

Holotype.— No. 2898, M. C. Z. (S. H. Scudder).

This ant has been described from a rather poorly preserved individual, but the small head will enable easy recognition.

Camponotus petrifactus, sp. nov.

Plate 6, fig. 5

Worker.— Length, 10.0 mm. Head oval, nearly twice as long as broad, with a rounded posterior margin; mandibles triangular, slender, armed with three sharp teeth; antennae slender, inserted close to the middle line of the head, all the segments about twice as long as broad; eyes small, placed well back on the posterior half of the head; thorax slender, much longer than the head, but not nearly as broad. Length of head, 2.4 mm.; scape, 2.4 mm.; funiculus, 3.0 mm.; thorax, 4.0 mm.; gaster, 3.6 mm. Width of head, 1.8 mm.; thorax, 1.5 mm.; gaster, 3.0 mm.

Holotype.— No. 2936, M. C. Z. (S. H. Scudder).

Paratypes.— No. 10,034, Peabody Museum; no. 17,020a, University of Colorado; no. 22,964, A. M. N. H.

The large size of this worker, as well as the shape of the head, shows that it cannot be associated with either of the two preceding queens. Only seven specimens have been found.

V. Comparison of the Tertiary and Recent Ants of North America

With the completion of our examination of the ants known from the Tertiary rocks of North America, we are in a position to compare this

fauna with that now occupying the same area. In doing this, however, it must be borne in mind that our knowledge of the Tertiary ants is very meagre, partly because the forms found at any one locality represent only the fauna which existed in a certain environment. For this reason the absence of a genus from a deposit only indicates that it was absent in that particular environment; it may very well have been present at the same time under different conditions, which did not favor preservation.

The recent ant fauna of North America has already been discussed by Wheeler in several publications (1908, 1910, 1917, 1928), so that only a brief survey need be presented here. Excluding a few types which are now restricted to the nearctic region (*Myrmecocystus, Veromessor, Novomessor,* etc.), and which probably had diverse origins, the North American genera may be conveniently separated into three groups, each with a definite tendency in geographical distribution:

1. The first of these contains the genera which are limited to the New World, and which are almost entirely confined to the neotropical region, only a few species extending as far northward as the southern part of the nearctic. Here belong *Eciton, Neoponera, Pachycondyla, Pogonomyrmex, Cryptocerus, Atta, Forelius,* etc.

2. The second division consists of genera which are widely distributed in the tropics of both hemispheres and which are represented in the temperate regions by a small number of species or subgenera, as *Stigmatomma, Sysphincta, Monomorium, Pheidole, Leptogenys,* etc.

3. The last group includes those genera which are cosmopolitan or which inhabit the holarctic regions, as *Ponera, Stenamma, Formica, Lasius, Camponotus,* etc.

None of the American Tertiary ants belong to genera which are now restricted to the nearctic region, just as none of the amber species can be referred to genera confined to the palearctic. On the other hand, the first group of genera defined above is well represented in the Florissant shales, by *Archiponera* (a close relative of *Dinoponera*), *Pseudomyrma, Pogonomyrmex,* and *Protazteca.* The second division is represented by *Pheidole, Dolichoderus,* and *Iridomyrmex;* and the third, by *Aphaenogaster, Liometopum, Formica, Lasius,* and *Camponotus.* It is obvious, therefore, that the ant fauna of North America contained the same geographical elements during the Tertiary as it does in recent times. The only genera (*Novomessor,* etc.) which now exist in this area, and which may have been excluded from the Tertiary fauna, probably arose during a later period than the Miocene. We cannot, of course, derive detailed conclusions from such a small amount of evidence without becoming

too speculative, but it is obvious that the North American ant fauna of the mid-Tertiary was as highly developed as that of Europe, for while the number of species, and consequently genera, is far less in the former than in the latter, the difference is due entirely to the Baltic amber, which happened to be an ideal medium for the preservation of the ants. The presence of four genera with neotropical affinities in the Florissant shales, and especially the fact that one of them (*Protazteca*) is the predominant genus of the fauna, is strongly suggestive that during the mid-Tertiary the nearctic ant fauna was rich in genera which are now restricted to the neotropical region.[1] The present limitation of the second group of genera mentioned above to the southern portion of the nearctic is probably the result of the cool climate which enveloped the northern region during the Pleistocene glaciation.

Although the tendency for some of the Florissant insects to show relationship to Old World forms (e.g. *Glossina*) has already been observed by Cockerell, it is worth while to consider the two genera of ants which show similar affinities — *Mianeuretus* and *Messor*. The presence of the former in these shales, and of *Protaneuretus* and *Paraneuretus* in the Baltic amber supports the conclusion derived from morphological studies of *Aneuretus* that the tribe Aneuretini is a primitive one, and shows that it was once widely distributed. The probable occurrence of *Messor* is also of much interest, since this genus is now confined to palearctic, Ethiopian, and northern Indian regions. The two nearctic genera, *Novomessor* and *Veromessor*, which are very closely related to *Messor*, may be descendents of a branch of the latter which existed in North America during the Tertiary. The presence of these Old World genera in the Colorado Miocene is analogous to that of the neotropical genus, *Erebomyrma*, in the Baltic amber.

Perhaps the most important contribution of the North American fossil ants is to our appreciation of the age of the family. For although our knowledge of the mid-Eocene ants (Green River) is very fragmentary, it is sufficient to prove that the fauna of the early Tertiary was not only large and varied, but essentially modern. The fact that ants are not common in the Green River formation is not necessarily an indication that they were rare at the time of the existence of the biota, but only that the conditions were not favorable for their preservation; the macerated condition of all the known ants of this deposit strongly suggests that their nests were remote from the lakes and that the insects were carried to the latter by streams or freshets. Not only

[1] Brues has observed (1910) that some of the parasitic Hymenoptera of Florissant also show neotropical affinities.

were these early Tertiary ants highly differentiated morphologically, but as Wheeler has shown (1914) the Lower Oligocene forms (Baltic amber) had a social life as highly developed as the recent species, some of the amber workers being even polymorphic (*Pseudolasius* and *Dimorphomyrmex*). "That many of them had learned to attend plant-lice and had therefore become 'trophobiotic' is shown by a block of amber in the Königsberg Coll. containing a number of workers of *Iridomyrmex goepperti*, together with a lot of their Aphid wards. That the amber ants kept myrmecophiles in their nests can scarcely be doubted, for at least three genera of Paussidae [1] (*Cerapterus*, *Pleuropterus* and an undescribed genus) are cited by Klebs in his list of amber Coleoptera. That these ants also had Acarine parasites is shown by two workers of *Lasius schiefferdeckeri* in the Königsberg Coll., each bearing a mite attached to the base of the hind tibiae. These specimens also show that the mites had already acquired the peculiar habit of affixing themselves to very definite regions of their host's integument." It is clear, therefore, from the specialized social habits of the Oligocene ants, and the high differentiation of those of the Eocene, that the family must have originated well back in the Mesozoic. While, of course, the Cretaceous period is almost a blank as far as any group of insects is concerned, it seems hardly possible that the Formicidae could have reached such a high state of development by the early Tertiary, if they had originated in the Cretaceous period, as suggested by Handlirsch (1908), or even in the Upper Jurassic, as proposed by Emery (1920). And although it may be difficult to imagine ants included within the same fauna as the gigantic Protodonata of the Permian, which Wheeler suggests as the possible time of their origin, the discovery of comparatively highly specialized Hymenoptera in the Jurassic of Turkestan (Martynov, 1925), leads us to believe that the ants were similarly developed during that period of the earth's history. Probably the chief reason why they have not already turned up in this formation is that the primitive groups, as the Dorylinae, Cerapachinae, and Ponerinae, are either subterranean or terricolous and consequently not likely to be entombed in a lake deposit. At any rate, the problem of the origin of the Formicidae, both in time and space, must wait for its solution until ants have been discovered in pre-Tertiary deposits.

[1] Wasmann (S. J.) has more recently described the amber Paussidae. (Zool. Anzeiger, **68** (1/2), p. 25–30, 1926.)

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THE LOWER PERMIAN INSECTS OF KANSAS
PART I.
INTRODUCTION AND THE ORDER MECOPTERA

By F. M. Carpenter.

With Five Plates.

CAMBRIDGE, MASS., U. S. A.:
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No. 2.—*The Lower Permian Insects of Kansas. Part I. Introduction and the Order Mecoptera*

By F. M. Carpenter*

Introduction

The Permian has long been recognized as the period of most rapid evolution of the insects. The contrast between the archaic fauna of the Upper Carboniferous and the relatively modern one of the Triassic is fully as great as that between the faunas of the Triassic and the Recent. Until lately, however, the fossil record of the Permian has been nearly a blank. In 1906, when Handlirsch published his revision of the fossil insects of the world, only 14 specimens, aside from cockroaches, had been described from the strata of this period. But in recent years the discovery of new and highly productive Permian beds has added so many well preserved fossils to this record that our knowledge of the Permian fauna is rapidly surpassing that of the other Pretertiary horizons.

Most of these new fossils have been secured in the Lower Permian beds of Kansas, which have already yielded upwards of 6000 specimens. The first insects were found in this deposit in 1899. During the winter of that year Dr. E. H. Sellards found two fossil wings in a collection of plants which he had obtained in the Wellington shales, just south of the town of Elmo, Kansas. Realizing the significance of his discovery he returned to the locality during the summers of 1902 and 1903, and after some difficulty in locating the proper layer, secured about 2000 specimens. At that time the taxonomy of fossil insects was in a deplorable condition. Handlirsch's work, which for the first time placed the classification of the extinct forms on a solid foundation, had not yet appeared, and the literature on the subject was extremely fragmentary and scattered. But between 1906 and 1909 Dr. Sellards published three papers on his collection, describing a few of the forms which seemed to be typical of the fauna. It was his intention at that time to publish a revision of the fossils, but other matters intervened and for many years this huge collection was stored in his home at Austin, Texas. In the spring of 1927 when I was enabled by a grant

* National Research Fellow, Bussey Institution. These studies have also been aided by grant No. 280 of the Bache Fund, National Academy of Sciences, and a Sheldon Traveling Fellowship from Harvard University.

from the National Academy of Sciences to make an extended visit at Austin, Dr. Sellards kindly placed his types at my disposal for examination, and the following year he sent me his entire unworked collection for study at the Bussey Institution.

Meanwhile, a second collection of insects had been obtained at the Elmo deposit. Dr. R. J. Tillyard, the eminent entomologist of the Cawthron Institute, New Zealand, had passed through this country in 1920, and while visiting Yale University had seen a small series of the Kansan specimens which Dr. Sellards had donated to the Peabody Museum many years ago. Tillyard aroused Professor Schuchert's interest in these insects, and the following summer Professor C. O. Dunbar undertook an expedition to the locality. He returned with a collection of about 2000 specimens, which were immediately sent to Dr. Tillyard for study. During the past four years Tillyard has published eleven papers on this fauna, covering the Palaedictoptera, Mecoptera, Protohymenoptera, Homoptera, Psocoptera, Protodonata, Odonata, and Protoperlaria. All the Yale specimens have remained the property of the Peabody Museum, with the exception of the counterparts of some of the types, which have been given to the Cawthron Institute.

In the fall of 1925 I accompanied Professor P. E. Raymond to the Kansan locality to determine whether or not another large collection of insects could be obtained at these beds. Our short stop at the deposit was sufficient to obtain an affirmative answer to this question (Carpenter, 1926), and two years later, with the financial aid of a Sheldon Traveling Fellowship and the assistance of two graduate students in entomology, I secured some 2400 specimens, comprising the third and largest collection from this formation. All these fossils are now at the Bussey Institution, but they will be turned over to the Museum of Comparative Zoölogy when my description of them has been completed.

The deposit which has yielded these splendid collections is situated in Dickerson County, Kansas, within the township of Elmo, and about three and one-half miles southwest of the town itself. The rock containing the insects, termed the "Elmo limestone" by Dunbar, has been found only in a pasture covering about thirty acres (Plate 1, fig. 1). This pasture has the typical rolling topography of central Kansas, so that there are very few natural exposures of the limestone, or in fact of any part of the Wellington series. A few meandering brooks have cut occasional gullies, but these are rarely over a few feet deep. All the Harvard and Yale specimens were obtained near the center

of the pasture, but Sellards' collection was taken about a quarter of a mile farther south. Fully half of the Harvard fossils came from the north side of a small ravine about twenty feet southwest of the gully which produced the Yale specimens; the remainder were taken in the west bank of Dunbar's quarry of 1921.

The stratigraphy of the Wellington shale in this region has been carefully worked out by Dr. Dunbar, and I can add nothing new to his excellent account (Dunbar and Tillyard, 1925). At both of the exposures where we collected in 1927, the Elmo limestone was capped by a few feet of a limy shale, unfossiliferous except for a few phylopod crustaceans. The Elmo limestone itself is a chalky, soft, almost white deposit, about five feet thick; only the very bottom, more massive layer of this stratum contains insects (Plate 1, figs. 2, 3). Just below the insect layer, extending down for a depth of about three feet, is a very soft, carbonaceous clay, containing many matted fronds and stems of land plants, and occasional large stumps of *Psaronius*[1] (Plate 1, fig. 4). Throughout the insect layer of the Elmo limestone there are a number of fragments of plants, a few arachnids, and one species of clam, *Myalina meeki* Dunbar. The latter is the commonest fossil, especially in the very basal part of the limestone, where the shells are crowded together in huge masses. Dunbar observed in his description of the beds that the insects and *Myalina* were mutually exclusive on any one layer of the rock, but this is certainly not true at all exposures. Another common fossil in the insect layer has the appearance of a pink alga, which seems to occur almost uniformly at about the same level. For some curious reason the insects are very closely associated with this fossil, or at least with the layer of rock on which it occurs; sometimes as many as twelve insects have been found on a square foot of this surface. The arachnids, *Eurypterus* and *Paleolimulus*, are quite rare, but are also associated with the insects. About fifty specimens of these two genera were taken in 1927, and have been turned over to Professor P. E. Raymond, of the Museum of Comparative Zoölogy. The plants of the insect layer are too fragmentary for accurate determination. Sellards described the flora of the Wellington shale in this region many years ago (1908), but a more complete account is contained in a monograph by David White, now in press.

The insects have a very sporadic horizontal distribution in the limestone. Some portions of the insect layer, only a few feet away from a rich pocket, seem to be almost devoid of specimens; or if the insects are present, they are badly macerated and poorly preserved. Our ex-

[1] Determined by Dr. David White.

perience in collecting leads us to the conclusion that these fossils can be obtained more easily if the rock is dry. When the limestone is damp, as it ordinarily is directly after its removal from the ground, its color is dark gray, and the minute insects, such as the Psocids, can be seen only with difficulty. The dry rock, however, is almost a chalky white, so that the insects can be seen much more readily. The dry limestone also has the advantage of splitting more evenly.

The climatic conditions which prevailed at the time of the existence of an extinct biota are always of interest and sometimes of great significance to the biologist. Dr. Dunbar's study on the geology of the formation leads him to conclude that the environment of the insects was a "swampy, forested lowland. This local moist habitat appears, however, to have been a humid spot in a regional environment of more or less pronounced and long-continued aridity, for the preceding strata of the entire province are marked by extensive saline deposits. The earlier stages of the Permian were characterized, over the Great Plains Province, by the alternating seasonal rainfall and droughts of a semiarid climate, and from this mild beginning the aridity gradually became more severe until it reached a climax in Wellington time, when the excessive evaporation of the inland sea resulted in the precipitation of thick salt beds over central and southern Kansas. Our insects lived shortly thereafter, at a time when the climate had again become somewhat ameliorated. The cold climate of the later part of the Lower Permian had not yet affected the region of Kansas, where decidedly warm temperatures still prevailed, and it is improbable that the insects of this portion of the United States had ever endured cold winters."

Since the Wellington shale has been definitely referred to the Lower Permian (Middle Artinskian), the insects of the Elmo limestone are the oldest of any of the Permian forms which have been found.[1] Only two other Permian formations have produced notable collections of insects. The Belmont cherts of New South Wales, which belong to the highest part of the Permian, have yielded a small but interesting series of Mecoptera, Neuroptera, Coleoptera, Homoptera, and Protocoleoptera (Tillyard, 1917, 1919, 1922, 1926); and the Upper Permian (Kazan) of North Russia has produced a varied fauna of Homoptera, Mecoptera, Neuroptera, Psocoptera, Protorthoptera, and a few extinct groups allied to the Perlaria (Martynov, 1928). The researches which have been conducted on these Permian insects, especially those of Till-

[1] Except, perhaps, the Hermit shale of the Grand Canyon, which has yielded two species of Protodonata (see White's note on the flora of the Hermit shale, Proc. Nat. Acad. Sc., **13** (8), p. 574–575, 1927).

yard's on the Kansan forms, have filled in many gaps in the phylogenetic tree of the insects. Yet our knowledge of these ancient types is still very meagre. Practically nothing is known of their body structure, and in many cases only portions of the wings have been found. Under such conditions it is only natural that some erroneous conclusions have been reached, but by the study of additional material most of these will be eliminated, and our conception of the geological history of the insects will become more exact. Consequently, although among the 4400 unstudied fossils now at my disposal, there are only a few new species, the addition of many details to those already known in the described forms, will, I hope, clear up some of the uncertainties and remove some of the inaccuracies which now exist. Since Tillyard has treated the Yale insects by orders, completing one group before starting on another, I propose to adopt the same method. This procedure was suggested to me by Dr. Tillyard in order that I might publish on the Palaeodictyoptera, Protohymenoptera, Psocoptera, Odonata, Protodonata, Mecoptera, Homoptera, and Protoperlaria, without in any way interfering with the investigations which he is now carrying out on the other orders. His earlier start on the Kansan insects should give him that priority.

It is a pleasure to acknowledge my gratitude to those who have aided me in this undertaking. To Professor W. M. Wheeler I am deeply indebted for the interest which he has taken in the progress of the investigation, and especially for the encouragement which he has always been ready to offer. To Professor E. H. Sellards, of the University of Texas, I am under lasting obligation for his courtesy in allowing me to study the types in his collection, and for the loan of the rest of this valuable assemblage of fossils. Sincerest thanks are also due to Mr. and Mrs. E. E. Bert and their family, of Abilene, Kansas, for many kindnesses extended while I was collecting at the Elmo deposit. To Messrs. J. W. Wilson and W. S. Creighton, of the Bussey Institution, I am more than grateful for their assistance in the field, as well as for the care which they employed in collecting the fossils with me in 1927.

The Order Mecoptera

The existing Mecoptera are but a remnant of the large series of forms which existed during the early Mesozoic and the Permian. Less than two hundred living species have been found over the world, and some monospecific genera, as *Merope* and *Notiothauma*, seem to be on the verge of extinction. The recent representatives of the order are

widely distributed, as one would expect, although the primitive groups are restricted to small areas. The family *Panorpidae* occurs throughout the North Temperate regions, the *Bittacidae* have been taken in all parts of the world, and the *Boreidae* range over Europe and North America. The *Nannochoristidae*, which possess a peculiar combination of specialized and primitive characteristics, are limited[1] to Australia, Tasmania, and New Zealand; the *Choristidae* are restricted to Australia; the monospecific family *Meropidae* is found only in eastern United States; and the *Notiothaumidae*, an obscure family known only from three individuals, is confined to parts of Chile.

Although the geological history of the order was very obscure less than a decade ago, it is now better known than that of any other group of holometabolous insects. Both the *Panorpidae* and *Bittacidae* are represented in the Tertiary of Europe and North America, and the latter family is also present in the Jurassic of Turkestan (Martynov, 1928; Carpenter, 1928). No other living families have been recognized in the Mesozoic rocks, but the extinct family *Orthophlebiidae* and its allies, which are closely related to the *Panorpidae*, have been found in the Jurassic of England, Germany, and Turkestan. The best specimens of these orthophlebiids have been taken in the Turkestan beds, and are especially interesting because they possess the long beaks characteristic of the more highly specialized modern Mecoptera. The next oldest record in the history of the order is that of the Triassic of Queensland, which contains three families, *Stereochoristidae*, *Mesochoristidae*, and *Archipanorpidae*. The two former families are related to the recent choristids, but the affinities of the *Archipanorpidae* are not clear. In the Upper Permian beds of New South Wales the family *Mesochoristidae* is still present, together with the *Belmontidae*, which are considered by Tillyard to belong to a distinct but related order, the *Paramecoptera*. The Upper Permian of Russia (Kazan), the fauna of which has recently been monographed by Martynov (1928), contains two genera strikingly similar to *Agetopanorpa*, new genus, from the Lower Permian of Kansas. Since I do not agree with Martynov on the affinities of the Russian Permian Mecoptera, I shall discuss these fossils more thoroughly after the description of the Kansan forms.

The Lower Permian of Kansas has yielded the earliest unquestionable records of true Mecoptera.[2] The Yale collection from this forma-

[1] Since this was written, the family has been found in South America.

[2] Tillyard regards the Carboniferous *Metropator pusillus* Handl. as a true Mecopteran, but this classification is open to question. See Crampton (C.G.), Bull. Brooklyn Ent. Soc., **22**, p. 12–13, 1927.

tion includes sixteen specimens, placed by Tillyard (1926) in fourteen species, and the small collection which the Museum of Comparative Zoölogy obtained in 1925 contained a single individual. The unstudied material now at my disposal includes thirty-eight specimens of this order, one of which is in Dr. Sellards' collection, and thirty-seven in the Harvard collection. As one would naturally suppose, these new fossils add much to our knowledge of the Permian Mecoptera, especially since many of them are extraordinarily well preserved. All the specimens which have previously been known from the Kansan beds consist of isolated wings, but fully half of the Harvard fossils possess fore and hind wings and portions of the bodies.

In addition to the Mecoptera in the Harvard and Sellards' collection, I have been able, through the kindness of Professor C. O. Dunbar, to study Tillyard's types at the Peabody Museum. To Dr. Dunbar I am also grateful for the use of apparatus which enabled me to examine these fossils under the best of conditions, and especially for the use of photographic equipment. Professor Dunbar also gave me permission to remove several bits of rock matrix which obscured portions of some of the types. The exposing of the hidden parts has added many important points to our knowledge of the species, and in the case of one fossil, *Protopanorpa pusilla* Till., has shown so many unexpected characteristics that a distinct family must be established for it.

Tillyard has already discussed the wing venation of the Mecoptera and its evolution in the *Panorpoid Complex* (1919), but since much additional material, both fossil and recent, has been accumulated in late years, it seems advisable to review the subject at this time. In the fore wing of all recent Mecoptera, the subcosta is apparently unbranched, although in *Chorista* it is connected distally to the costal margin by an oblique veinlet. This veinlet, in my opinion, is the vestige of an anterior branch of the forked subcosta which is present in the *Permopanorpidae, Permochoristidae,* etc. R1 usually possesses one or more distal veinlets which run through the pterostigmatic area, and in the older fossil Mecoptera these veinlets are distinctly dichotomous in their origin. A number of genera, however, even the Permian *Petromantis* and *Agetopanorpa,* new genus, have R1 unbranched. The radial sector is a well developed system, originally possessing four main branches, each of which, in the more primitive groups, is forked at least once, so that as many as ten terminal branches may result. In the highly specialized forms, as *Nannochorista,* the number of terminal branches is only three. The media divides basally into M1-4 and M5, the latter being partly present as a free vein in only the

primitive genera, where it forms the upper arm of the Cu-M Y-vein. In *Platychorista* there may be as many as nine terminal branches to M1-4, but in all recent Mecoptera there are not more than four terminal branches (normally). The cubitus divides basally into Cu1 and Cu2, the former diverging upwards to fuse with M5, forming a composite vein, M5+Cu1, which leads directly to the posterior margin of the wing. Tillyard has always regarded this vein as being unbranched in all Mecoptera, but as a matter of fact it is distinctly forked in *Platychorista venosa* Till., as will be shown later. Cu2 is a simple vein in all known forms. The three anal veins are free, and either forked or simple. The Cu-M Y-vein is the most important phylogenetic structure in the wing. The basal stem of the "Y" is formed by the composite vein, M5+Cu1, the right arm by the free part of M5, and the left arm by the free piece of Cu1. The primitive condition of this structure is best seen in the *Permopanorpidae*, *Platychoristidae*, and *Meropidae*, both M5 and Cu1 being equally well developed. A somewhat higher stage is represented by *Permochorista*, *Panorpodes*, and *Panorpa*, in which M5 is shortened and has assumed the position of a cross-vein. The next step is present in *Chorista*, M5 having almost disappeared, and the most highly specialized condition is found in *Bittacus*, in which Cu1 has fused for a short distance with M1-4, and M5 has completely vanished.

The hind wing is similar to the fore, but is by no means identical. It is always shorter and more narrowed basally; the subcosta is shorter than that of the fore wing; and in all recent forms 1A and Cu2 are fused for a short distance. M5 is not present as a free vein in the hind wing of any known Mecopteran; even when this structure is well developed in the fore wing, it is entirely missing in the hind pair. Since none of the specimens of Mecoptera in the Yale collection had both pairs of wings preserved, Tillyard was not able to determine just how much the venation of the hind wing had been modified by the time of the Lower Permian. He considered it probable that the fusion of 1A with Cu2 had not then been reached, and he also assumed that M5 was a free vein, the Cu-M Y-vein being completely formed as in the fore. The fossils in the Harvard collection show that the fusion of 1A with Cu2 had not been attained in the Permian forms, but that M5 was entirely absent, Cu1 joining the stem as in recent Mecoptera. Tillyard has already observed (1919) that the "main line of evolution within the Mecoptera has been by narrowing of the wings, with suppression of the original archaic branches of Rs and M1-4. With the narrowing there has proceeded also a lengthening process, which culminates in such forms as the *Bittacidae*." If we bear in mind that the

hind wing in all known forms is somewhat ahead of the fore wing in the narrowing process, it is not surprising to find M5 absent in the Permian Mecoptera, even though it has disappeared in the fore wing of only the highly specialized recent groups.

The Mecoptera in the Yale collection were separated by Tillyard into three families: *Protomeropidae*, *Permopanorpidae*, and *Anormochoristidae*. Unfortunately, one change must be made in this arrangement. The genus *Protomerope* Till. is synonymous with *Platychorista* Tillyard (placed by him in the *Permopanorpidae*), so that because of page precedence the family name of this Merope-like insect must become *Platychoristidae*. Two additional families, *Agetopanorpidae* and *Lithopanorpidae*, are established in this paper, the former for a new species in the Harvard collection, and the latter for Tillyard's *Protopanorpa pusilla*.

PLATYCHORISTIDAE

Small insects, allied to the recent *Meropidae*.

Fore wing.— Costal space broad, traversed by a number of oblique veinlets leading to the costal margin from Sc, and also from the part of R1 in the pterostigmatic area; pterostigma weakly developed; Rs and M with numerous dichotomous branches; Cu-M Y-vein strongly formed; Cu1+M5 forked distally; Cu2 unbranched, terminating on the posterior margin of the wing; 1A looped to Cu2 and 2A looped to 1A, distally.

Hind wing.— Shorter than the fore wing, and more narrowed basally; costal space much narrower than that of the fore wing, traversed by a small number of veinlets; Sc shorter than in the fore wing; branching of Rs and M similar to that of the fore wing; Cu-M Y-vein absent; Cu1+M5 simple, joined directly to the stem of the media; Cu2 forked; 1A unbranched, 2A forked.

Macrotrichia are well developed on the main veins of both wings.

Prothorax small, apparently not prolonged over the head as in *Merope*. Female with a rather robust, tapering abdomen, terminating in a pair of short cerci; male with a much shorter abdomen, apparently terminating in a pair of small claspers.

Platychorista Tillyard

Platychorista Tillyard, Amer. Journ. Sci., **11** (62), p. 154, 1926.
Protomerope Tillyard, Amer. Journ. Sci., **11** (62), p. 157, 1926.

Fore wing.— Costal space narrowed basally; hm present; Sc reaching to the pterostigma and terminating in a short fork, one branch of which

leads to the apical margin, the other to R1; Rs with ten or twelve branches, variable in their arrangement; R straight basally, but with a distinct downward bend before the origin of Rs; M with nine to eleven branches, variably arranged; Cu-M Y-vein with a straight upper arm (M5) and a sigmoidal lower arm (Cu1), which is more than twice as long as the upper. Cross-veins few and weakly developed.

Hind wing.— Costal space only slightly narrowed basally; hm present; Rs and M branched essentially as in the fore wing; Rs straight basally, but with the bend much nearer the base and more abrupt than in the fore wing; Rs originating at the apex of this bend; Cu1+M5 and Cu2 very close together, almost fused; both Cu1+M5 and Cu2 fused with M basally; cross-veins apparently more weakly formed than in the fore wing.

Genotype.—*Platychorista venosa* Till.

Platychorista venosa Till.

Plate **3**, fig. 1; Plate **4**, fig. 2

Platychorista venosa Tillyard, Amer. Journ. Sci., **11** (62), p. 154, 1926.
Protomerope permiana Tillyard, Amer. Journ. Sci., **11** (62), p. 159, 1926.

Length of female (excluding head), 3.6 mm.; length of male (excluding head), 2.5 mm.

Fore wing.— Length, 5.6 mm.; greatest width, 1.7 mm.; elongate oval, the apex well rounded, the center of the apex falling on the longitudinal axis of the wing; subcostal veinlets, 10–12, usually more oblique apically than basally; R at base variable with respect to the amount of bend before the origin of Rs; pterostigma rather short, unpigmented, with 4 or 5 veinlets; R very straight after the origin of Rs until it reaches the pterostigma, where it makes a second bend; R2 with 2–4 branches; R3 and R4 with 2 branches; R5 with 2-4 branches; M close to R at base, M5 separating off just before the origin of Rs; M1+2 diverges from M3+4 just a little basad of the first division of Rs; M1, M2, and M3 with 2 branches; M4 with 3–4 branches; the free basal part of Cu1 is nearly parallel with the longitudinal axis of the wing; the fork of Cu1+M5 is rather deep, going back nearly as far as the first branch of M4; Cu2 and 1A almost parallel and rather close together for their entire lengths; 1A unbranched; 2A and 3A apparently widely forked distally; a very strong, sigmoidal cross-vein is present between R1 and Sc, just apically of the origin of Rs; the other cross-veins seem to be quite variable in position.

Hind wing.— Length, 5.0 mm.; greatest width, 1.3 mm.; well rounded apically, the center of the apex a little anterior of the longitudinal axis of the wing; only 3 or 4 subcostal veinlets; Sc terminating in front of the pterostigmata; R1 gently curved sigmoidally after the origin of Rs, so that it very nearly touches Sc just above the first division of Rs; pterostigma a little longer than in the fore wing, with 2 or 3 veinlets, but no pigmentation; Rs originating very close to the base of the wing, dividing soon after into its main branches; R2 and R3 usually divide directly above the separation of R4 and R5; M separates into M1-4 and M5 apically of the first division of Rs; the branches of M1-4 usually resemble those of the fore wing; Cu1+M5 is much crowded distally between Cu2 and the posterior branch of M4, but it disappears into the wing membrane before reaching the wing margin; 2A forks at about half its length; 3A unbranched. The costal space, including the pterostigmatic area, bears 4 small circular eye-spots, the first and smallest at the first veinlet, the second on the next veinlet, the third on the following veinlet, and the fourth in the middle of the pterostigma.

The thorax is quite broad, with a small prothorax. The first four abdominal segments of the female are about as broad as long, the others much longer than broad, although the length of these segments is undoubtedly dependent upon the degree of contraction of the abdomen. The cerci on the 10th segment are well developed, but the exact number of segments is not definitely known. The external genitalia of the male of this species are preserved in one specimen in the Harvard collection (3007ab). They are in the form of short claspers, somewhat similar to those of *Merope*, but much smaller.

Holotype.— No. 5067 (hind wing), Peabody Museum. Specimens Nos. 5069a and 5070b in the Yale collection, described by Tillyard as the holotype and paratype (respectively) of *Protomerope permiana*, are fore wings of this species.

The Harvard collection contains eight specimens, as follows: no. 3001ab,[1] a complete fore wing, very well preserved, collector, F. M. Carpenter. No. 3002ab, complete fore wing, splendid preservation; collector, F. M. Carpenter. No. 3003ab, apical two-thirds of fore wing; collector, F. M. Carpenter. No. 3004ab, complete fore wing, fairly well preserved. No. 3005ab, complete fore wing; collector, J. W. Wilson. No. 3006ab, a female, consisting of the basal portions of the fore wings, and the body complete except for front of head; collector, F. M. Carpenter. No. 3007ab, a male, consisting of all four wings and body, except head; collector, F. M. Carpenter. No. 3008ab, probably female,

[1] The letters "ab" indicate the presence of both obverse and reverse.

fore wing complete, most of hind wings, and portions of body; collector, W. S. Creighton.

As I have indicated above, Tillyard described the hind wing of this insect as *Platychorista venosa*, which he considered to be the "highest evolutionary type" within the family *Permopanorpidae*. The fore wing he described as *Protomerope permiana*, placing it in a separate family, *Protomeropidae*, which he regarded as directly ancestral to the recent *Merope*. Fortunately, the complete specimens in the Harvard collection enable us to correlate these two wings. It will be observed, however, that my description of the fore and hind wings differs in many respects from Tillyard's. In the fore wing Tillyard described an unbranched Cu1, whereas I have figured it as being forked. Every one of the eight specimens in the Harvard collection has this vein forked, to the same degree and with the same distinctness. Specimen no. 5069a in the Peabody Museum (the holotype of *Protomerope permiana*) is lacking a bit of the wing near the termination of Cu1, including the area occupied by the anterior fork, so that Tillyard could not know from this fossil whether the vein was branched or not. The other specimen of the fore wing in the Yale collection (No. 5070a, the paratype of *Protomerope permiana*) is much better preserved and shows the distal fork of Cu1+M5 so clearly that I do not understand how Tillyard could have overlooked it. Tillyard also stated that in the fore wing 1A terminates on Cu2, as shown in his figure. But as a matter of fact, his 1A is really 2A, and his 2A is 3A, for there is another vein, the true 1A, situated between Cu2 and his so-called 1A. This true 1A is very faintly preserved in the Yale specimen numbered 5069a, but is quite distinct in the other fossil. In the hind wing, the free piece of Cu1 is not present, although Tillyard has indicated it in his figure; instead, Cu1+M5 joins M at the very base of the wing, as in all other known Mecoptera. I examined his holotype of *Platychorista venosa* with the greatest care, but could not find the slightest trace of a free basal piece of Cu1, and could not find it in any of the Harvard specimens. Cu1+M5 is a weakly developed vein, parallel and very close to Cu2; this peculiar condition is not due to distorted preservation, for it is found in all the hind wings in the Harvard collection, and in the Yale holotype as well, although it was overlooked there by Tillyard. Cu2 is really forked, not unbranched as described by him. The peculiar concavity of the anterior margin of the wing as drawn by Tillyard is merely the result of the distorted position in which the insect lies on the rough rock. The holotype specimen at Yale shows distinctly the four small eyespots on the costal space, although these are not mentioned in Tillyard's description.

In working out the venation of this insect I was somewhat disconcerted by the variability of the structure of the radial sector. Some of the different types of branching which occur are shown in text figure 1. It will be observed that the position of the origin of Rs, as well as

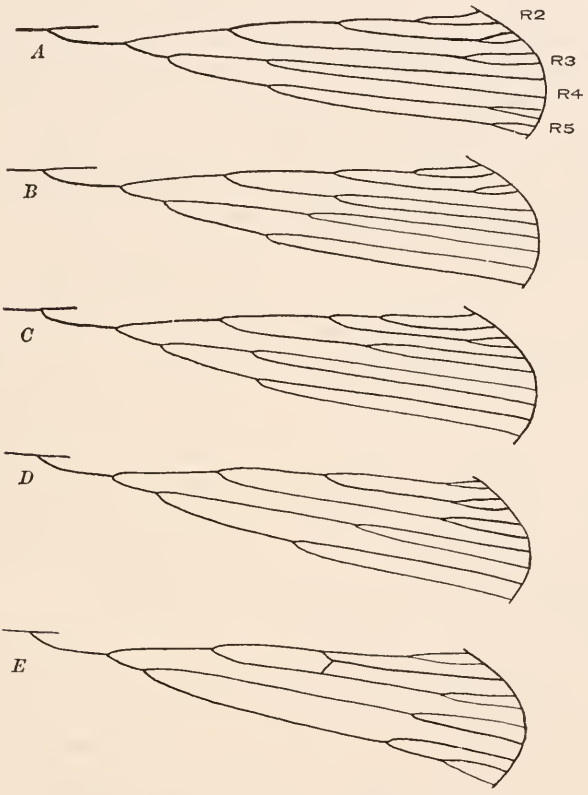

Fig. 1.— Variations in the radial sector of *Platychorista venosa*: A, No. 3003; B, No. 3004; C, No. 3005; D, No. 3007; E, No. 5669 (Yale).

the point of origin of each of the four main branches of this vein are constant; the variation takes place in the number and position of the additional forkings. A similar but less marked variation takes place in the radial sector and media of the recent *Merope tuber*.

The new specimens of *Platychorista venosa* contained in the Harvard collection have added so many details to our knowledge that we are

now in a position to consider fairly accurately its affinities. Tillyard regarded *Protomerope*, which he based upon the fore wing of this species, as "undoubtedly the direct ancestor of the recent North American genus *Merope*, and probably also of the South American genus *Notiothauma*." As far as the fore wing of *Platychorista* is concerned this might be true, for even the fork on Cu1+M5 only means that the genus is a little farther down the phylogenetic tree of the Panorpoid orders than Tillyard supposed, and much closer to the archetype of the complex. But from the evidence afforded by the hind wing I cannot agree that this genus is in the line of direct ancestry of *Merope* or *Notiothauma*. In the hind wing of *Merope* the cubitus originates and divides in a manner not very unlike that of *Panorpa* and the other recent Mecoptera, the basal part of Cu1 being fused to the media, and the corresponding part of Cu2 being fused to 1A. The very close association of Cu2 with Cu1+M5 in *Platychorista* is a specialization which certainly could not have given rise to the perfectly normal structure in *Merope*. The crowded condition of Cu1+M5 distally is a high specialization found in no other Mecopterous forms, although it does recall the more advanced state in *Stereochorista frustrata* Till., from the Upper Triassic of Ipswich, Queensland. The obvious conclusion is that although *Platychorista* is certainly the closest relative of *Merope* that has thus far been found as a fossil, it is too highly specialized along other lines to enable us to place it as the ancestor of *Merope*. It is more probable that the family *Platychoristidae* is an end branch which diverged from the true ancestors of the *Meropidae* during the earlier Permian or perhaps the Upper Carboniferous.

Tillyard also pointed out that there are many resemblances between *Platychorista* and the primitive Neuroptera, and concluded that the Lower Permian ancestor of the Neuroptera must have been closely allied to *Platychorista*. The additional characteristics of the fore wing which have been presented here serve to substantiate this conclusion. The distal forking of Cu1+M5 and the termination of 1A on the wing margin are features of the archaic Neuroptera. At the time when Tillyard's suggestion was made, the oldest known Neuroptera were the *Permithonidae*, from the Upper Permian of Australia, but recently several other Neuroptera have been described from the Russian Permian by Martynov (1928) and Zalessky (1926). The venation of one of these species, *Palaeomerobius proavitus* Mart., is strikingly similar to that of *Platychorista*, being more specialized only in the twigging of the main branches, and the loss of M5. It is obvious, however, from the absence of the Cu-M Y-vein in the hind wing of *Platychorista*, and its normal development in the hind wing of the

primitive recent Neuroptera, that this Lower Permian genus cannot have been directly ancestral to the order Neuroptera.

PERMOPANORPIDAE

Minute insects related to the recent *Panorpidae* and *Choristidae*.

Fore wing (known in *Permopanorpa* and *Protopanorpa*).— Shape much as in *Panorpa;* costal space narrow or fairly broad, traversed by a small number of veinlets; humeral cross-vein always present; pterostigma well developed; Sc forked distally; R1 strongly formed, usually with one or more pterostigmatic veinlets; Rs with from 4–9 terminal branches, also dichotomous; Cu-M Y-vein well developed; Cu1+M5 strongly formed, unbranched, straight or nearly so; Cu2 weakly formed, unbranched, usually gently curved; 3 anal veins present, somewhat variable in position and termination.

Hind wing (known in *Protochorista* and *Permopanorpa*).— Shorter than the fore wing, and more narrowed basally; costal space as in the fore wing, but Sc much shorter; branches of Rs and M as in fore wing; Cu1+M5 leading directly to the base of M, the Cu-M Y-vein being entirely absent.

The main veins of both wings are pitted with the large bases of macrotrichia, which are themselves very well preserved in many of the Harvard specimens. Tarsi 5-segmented, the basal segments being markedly longer than the others, as in all recent Mecoptera; legs with two tibial spurs, and coated with hairs as in recent Mecoptera, but without the numerous spines on the tibiae present in the *Panorpidae*. Female with a pair of short cerci protruding from the end of the abdomen, and possessing at least 3 segments; male with short, protuberant genitalia, closely resembling those of the recent *Bittacidae*.

This family was established by Tillyard to include four genera from the Kansan Permian, *Permopanorpa*, *Protopanorpa*, *Protochorista*, and *Platychorista*. The latter genus belongs to a separate family, corresponding to Tillyard's *Protomeropidae*, as I have shown above. Martynov also placed in the *Permopanorpidae* the genera *Petromantis* and *Kamopanorpa* from the Russian Permian, but these, together with a new Kansan genus, belong to a distinct family, described below.

Permopanorpa Tillyard

Permopanorpa Tillyard, Amer. Journ. Sci., **11** (62), p. 143, 1926.

Fore wing.— Elongate, well rounded apically; costal space narrow, very slightly concaved, nearly straight; Sc terminating on the costal

margin before the pterostigma, its anterior distal branch much reduced; R1 straight, with 1–4 pterostigmatic veinlets; pterostigma elongate, but somewhat variable in size; Rs with from 5–9 terminal branches; M with 6 terminal branches, constant in their arrangement; M1 and M2 forked distally, M3 and M4 unbranched; Cu-M Y-vein with the free part of Cu1 about twice as long as M5; number and arrangement of cross-veins variable.

Hind wing.— Sc terminating on the costal margin before the middle of the wing; pterostigma shorter than in the fore wing; Rs originating nearer to the base than in the fore wing; branching of Rs and M as in the fore wing; Cu1 diverging from Cu2 close to the base of the wing, the free part of Cu1 being oblique and weakly developed; 3 anal veins, 1A fused with 2A for a short distance. Head with a small beak, about as long as that in *Chorista;* eyes large, rounded, not protuberant; antennae with 16 segments; body with about the same habitus as that of *Panorpa;* legs about as slender as those of *Panorpa,* the prothoracic pair being somewhat shorter than the others.

Genotype.— *Permopanorpa formosa* Till.

This genus, as observed by Tillyard, is closely related to the recent *Panorpidae, Choristidae,* and the extinct *Orthophlebiidae.* It cannot, however, be in the line of direct ancestry of any of these families, since the media is developed in quite another direction. In the hind wing, also, the fusion of 1A with 2A is a specialization which could hardly have produced the type found in the three families mentioned.

In the Yale collection Tillyard found seven specimens belonging to this genus, each of which he assigned to a distinct species. These species were separated on such characters as the relative lengths of the arms of the Cu-M Y-veins; the presence or absence of pterostigmatic veinlets and the anterior branch of the subcosta; and the number of terminal branches to Rs. Shortly after the description of the Yale species, I described the one which the Museum of Comparative Zoölogy obtained in 1925 as *P. raymondi,* using the same distinguishing characteristics as Tillyard had employed. Of this series of eight species, *P. formosa,* as described by Tillyard, differs markedly from the rest by its relatively large size, and *P. schucherti* is made distinctive by its peculiar system of cross-veins. When I began to study the 24 specimens in the Harvard collection which belong to this genus, I observed that in every one the arms of the Cu-M Y-vein were unequal, Cu1 always being about twice as long as the free part of M5. It seemed advisable, therefore, to examine Tillyard's types in the Peabody Museum, and this I was able to do through the kindness of Dr. Dunbar. This

study of the types showed conclusively that the Cu-M Y-vein in *P. tenuis, dunbari,* and *sellardsi* was formed exactly as in *gracilis* and *inaequalis*, with the arms unequal, not equal, as stated by Tillyard. A photograph of the type of *P. tenuis*, which shows clearly the structure of the Y-vein, is reproduced here for reference. This constant form of the Y-vein aroused my suspicions as to the validity of *P. gracilis, P. inaequalis, P. tenuis, P. dunbari,* and *P. sellardsi,* and induced me to examine the types with particular attention to the other characteristics which Tillyard selected as specific. My notes on these specimens follow:

1. The type of *P. inaequalis* is not quite as Tillyard figured it.[1] Rs joins the stem of R at the lowest point in the bend of R, just as it does in *gracilis, sellardsi,* and the others. The vein which Tillyard calls R4b actually diverges from R5, and is only joined to R4 by a cross-vein. In my opinion the peculiar shape of the wing of *inaequalis* is merely due to distortion, the specimen being on a rough rock surface and poorly preserved, as mentioned by Tillyard.

2. In addition to the form of the Cu-M Y-vein as already mentioned, the type of *P. tenuis* deserves some comment. The pterostigma is faintly preserved, and, since the greater part of it is missing, there may very possibly be veinlets present. The small piece of rock which originally covered a portion of the hind margin of the wing was removed with a fine needle, exposing a simple M4, as in *inaequalis.*

3. The type of *P. gracilis* is exactly as Tillyard described it, but I believe that the small indentation of the hind margin, which he figures at the termination of 3A, is merely due to a slight wrinkle in the wing membrane.

4. In the type of *P. dunbari,* the pterostigma is so darkly pigmented that even if veinlets were present they could not be discerned. Tillyard stated in his description that the basal portion of the wing was obliterated, but as a matter of fact it was only covered up by a small chip of the limestone, which was easily removed by a fine needle. This part of the venation turned out to be the same as that of *P. inaequalis.*

5. In the type of *P. sellardsi* the subcosta is forked distally. The Cu-M Y-vein is exceedingly faint, but a careful scrutiny of this structure brought me to the conclusion that the arms of the "Y" are unequal, as mentioned above.

It is clear from these observations on the types that the Yale speci-

[1] The figures of *P. tenuis* and *inaequalis* are incorrectly labeled in Tillyard's paper (Amer. Journ. Sci., **11** (62), p. 146–147). Fig. 8 is *P. tenuis* and Fig. 9 is *inaequalis*, and the descriptive titles under these illustrations should be interchanged.

mens are much more alike than Tillyard supposed. The subcosta is forked in all; the pterostigmatic veinlets are present except when the wing is poorly preserved or the pterostigma so heavily pigmented that

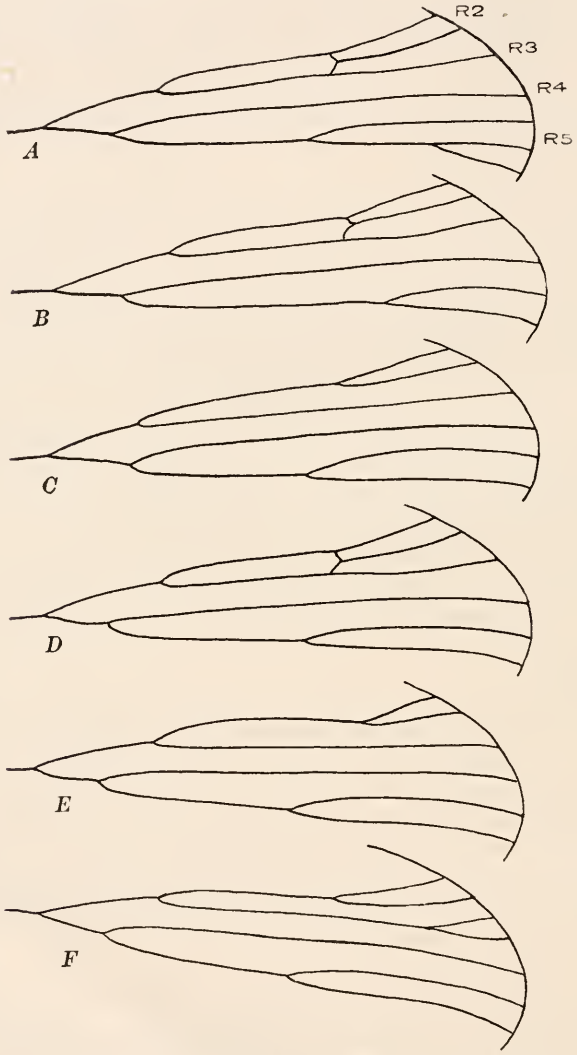

FIG. 2.— Variations in the radial sector of *Permopanorpa inaequalis:* A, No. 3021; B, No. 3016; C, No. 3010; D, No. 3019; E, No. 3018; F, No. 3013.

they cannot be seen; and the arms of the Cu-M Y-vein are identical in size and shape. When I continued my examination of the Harvard fossils, I was surprised to find slight and inconsistent differences in the branching of the radial sector, in the number of cross-veins between Sc and the costal margin, and in the degree of development of the anterior branch of Sc. A few variations of the media possessed by the Harvard specimens are shown in text figure 2, and others can be seen in Tillyard's illustrations. No two wings in the Harvard or Yale collections are alike in venation, and no two variations can be correlated or coupled. There is also some diversity in the shape of the wings, but allowing for distortion during preservation this is no greater than in many of our existing species of *Panorpa*. The only actual difference between all these specimens is in the number of terminal branches on the radial sector. If we recognize each of these types of branching as of specific rank, we must place every specimen in the Harvard and Yale collections into a distinct species. This procedure would be as absurd as assigning all the specimens of *Lemmatophora typa* Sell., of the Kansan beds, to separate species (Tillyard, 1928). The only alternative is to consider all these fossils as representing a single species with a variation more marked than in recent Mecoptera, yet quite consistent with that which we find in most ancient insects. This evidence places *P. inaequalis, tenuis, gracilis, dunbari, sellardsi,* all described by Tillyard, as well as *P. raymondi* Carp., into a single species, which must be named *inaequalis,* by page precedence.

Permopanorpa inaequalis Tillyard

Plate **2**, fig. 2; Plate **4**, fig. 1; text fig. 3

Permopanorpa inaequalis Tillyard, Amer. Journ. Sci., **11** (62), p. 145, 1926.
Permopanorpa tenuis Tillyard, ibid., p. 146.
Permopanorpa gracilis Tillyard, ibid., p. 147.
Permopanorpa dunbari Tillyard, ibid., p. 149.
Permopanorpa sellardsi Tillyard, ibid., p. 150.
Permopanorpa raymondi Carpenter, Bull. Mus. Comp. Zoöl., **67** (13), p. 438–439, 1926.

Length of ♀, 4.0 mm.; length of ♂, 5.0 mm.

Fore wing.— Length, 4.6–5.4 mm.; greatest width, 1.4–1.6 mm. Sc terminating on the costal margin just a little beyond the middle line of the wing; the anterior branch of Sc is usually reduced so that it has the appearance of a cross-vein, but it may also be quite oblique and relatively long; R straight at the base, curving downward just below

hm, then continuing nearly parallel with the longitudinal axis of the wing; the degree of bend in R is somewhat variable; R1 straight, with 1–4 pterostigmatic veinlets; Rs originating at the lowest point in the bend of R; R2 unbranched, or forked distally; R3 and R4 usually simple, but occasionally forked; R5 with 2–3 branches; Rs furcates shortly after its origin, R4+5 dividing just a little before the division of R2+3; M more or less completely fused with R at the base; M1-4 diverging from M5 distinctly before the origin of Rs; M1+2 diverges from M3+4 just beneath the first division of Rs; M2+3 forks a little apically of the separation of M3 from M4, and M2 forks before M1; the free piece of M5 very slightly curved, and the free portion of Cu1 gently sigmoidal; Cu2 and 1A remote distally, but much converged basally; 1A and 2A quite remote; 2A and 3A roughly sigmoidal in shape.

Hind wing.—Length, 4.0–4.2 mm.; greatest width, 1.0–1.2 mm. Sc terminating before the middle of the wing, anterior branch missing; R and R1 shaped as in the fore wing, except that the bend in R takes place much nearer the base and is less pronounced; pterostigma shorter than in the fore wing, and with only two pterostigmatic veinlets; Rs originating much nearer to the base than in the fore wing; branching of Rs similar to that of the fore, except that the division of R2 from R3 invariably takes place much more apically than in the fore wing; Cu1+M5 a very straight vein; free part of Cu1 markedly oblique; Cu2 nearly parallel to Cu1+M5 for its entire length; 1A fused to 2A from the base to near the wing margin, where the two veins diverge as a wide fork. Distribution of cross-veins about as in the fore wing, except that the area between the termination of Sc and the beginning of the pterostigma is strengthened by two strong, oblique cross-veins.

Holotype.—No. 5058, Peabody Museum.

The following specimens of this species are in the Harvard collection: No. 3009ab, fore and hind wings and most of body; collector, F. M. Carpenter. No. 3010ab, fore wing, excellent preservation; collector, W. S. Creighton. No. 3011ab, fore and hind wings, and portions of body; collector, J. W. Wilson. No. 3012, complete fore wing; collector, F. M. Carpenter. No. 3013, fore wing, splendid preservation; collector, F. M. Carpenter. No. 3014ab, fore and hind wing and parts of body; collector, F. M. Carpenter. No. 3015ab, hind wing; collector, F. M. Carpenter. No. 3016ab, fore and hind wings and parts of body; collector, F. M. Carpenter. No. 3017, hind wing; collector, J. W. Wilson. No. 3018ab, complete fore wing; collector, F. M. Carpenter. No.

3019ab, fore and hind wings and body; collector, W. S. Creighton. No. 3020ab, fore wing; collector, F. M. Carpenter. No. 3021ab, fore and hind wings; collector, J. W. Wilson. No. 3022ab, fore and hind wings, and body; F. M. Carpenter. No. 3023ab, hind wing; collector, F. M. Carpenter. No. 3024ab, fore wing (poor) and parts of body; collector, F. M. Carpenter. No. 3025ab, portions of wings and body (♂); collector, F. M. Carpenter. No. 3026, fore wing and parts of body; collector, W. S. Creighton. No. 3027ab, fore and hind wings, and portions of body; collector, J. W. Wilson. No. 3028ab, fore wings, and body; collector, J. W. Wilson. No. 3029ab, portions of wings and body; collector, F. M. Carpenter. No. 3030ab, parts of all four wings; collector, W. S. Creighton. No. 3031ab, fore wing and part of body; collector, F. M. Carpenter. No. 3032ab, four wings and body; collector, F. M. Carpenter. No. 3033ab, fore wing; collector, F. M. Carpenter. In Dr. Sellards' collection there is only one specimen, No. 1402, consisting of a fore wing.

This species is one of the most completely known fossil insects, and certainly the best known fossil Mecopteran. It possesses several interesting characteristics which one would hardly expect to find in a Permian scorpion-fly. The antennae, which are preserved in three of the Harvard fossils, are shorter than in any other extinct or recent species. In *Chorista* there are upwards of 50 segments; in *Panorpa* and *Panorpodes*, between 40 and 50; in *Merope*, 27–30; in *Nannochorista*, 22–25; in *Boreus*, 20–24; and in *Bittacus*, 16–20. Obviously, in the more highly specialized genera, as *Nannochorista*, *Bittacus*, and *Boreus*, the number of segments is down in the lower twenties or even less; whereas in the more primitive forms, the tendency is to increase this number from 30 to 50. It is therefore very surprising to find a Lower Permian Mecopteran with only 16 segments, a number which is found only in the highly developed *Bittaeidae*. The shape of the antennal segments, however, is much more like that in *Merope* than in the *Bittaeidae*. The male genitalia of *P. inaequalis* are perhaps the most surprising feature of all. The external genitalia of the males of the *Panorpidae*, *Choristidae*, and *Nannochoristidae* are in the form of a swollen bulb on the end of the abdomen; in *Merope* they appear as a pair of long narrow claspers; in *Boreus* they are very small and reduced. But in the *Bittacidae*, which are considered to be on a level with the *Borcidae* as the most highly specialized of the recent Mecoptera, the male genitalia consist of several thin, almost membraneous appendages, utterly different from those of the other Mecoptera. It is this type of genitalia that the males of *Permopanorpa* possessed, as

shown in text figure 3, so we are obliged to admit that this Lower Permian genus had essentially the same genital and antennal structure as the most highly specialized of our recent Mecoptera.

The variation in the venation and shape of the wing of *Permopanorpa inaequalis* is interesting, also. In order to determine something of the degree of variation which exists in recent Mecoptera, I examined over 3000 specimens of North American species, which were loaned to me by the Museum of Comparative Zoölogy, the American Museum of Natural History, the National Museum, and other institutions.[1] Certain of the species show a remarkable variation in the form of the branches of Rs, a peculiarity which has also been recorded by Esben-Petersen (1921). It is this same vein, as previously mentioned, which showed the greatest amount of variation in both *Permopanorpa* and *Platychorista*, so that it seems that at least some of the recent Mecoptera have retained the instability in the structure of the radial sector which was even more evident in the Permian forms. The shape of the wings in most of the species of *Panorpa* shows very nearly as much variation as appears to have been common in the Permian types.

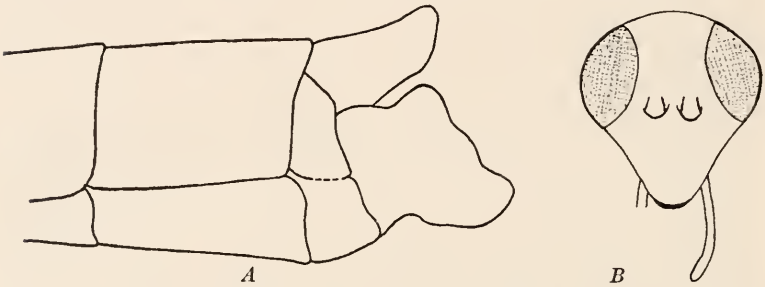

FIG. 3.— *Permopanorpa inaequalis:* A, lateral view of the terminal segments of male abdomen, from specimen No. 3015, M. C. Z.; B, front view of head, from specimen No. 3017, M. C. Z.

PERMOPANORPA FORMOSA Tillyard

Permopanorpa formosa Tillyard, Amer. Journ. Sci., **11** (62), p. 144.

There are no specimens of this species in the Harvard collection, and there is no necessity to redescribe the species here. It is quite probable that *P. formosa* is the same as *P. inaequalis*, also, for it does

[1] The results of this study are contained in a monograph of the Mecoptera of North America, now nearing completion.

not possess a single venational characteristic which is absent in some specimen of the latter species. The type specimen, however, is distinctly larger than any of those which have been referred to *P. inaequalis*, and since the basal part of the wing is missing, including the free piece of Cu1, it seems advisable to leave the specimen in a distinct species until more evidence is found to the contrary.

Holotype.—No. 5057, Peabody Museum.

Permopanorpa schucherti Tillyard

Permopanorpa schucherti Tillyard, Amer. Journ. Sci., **11** (62), p. 148.

This species is not present in the Harvard collection. Unfortunately, the half of the type specimen which is at the Peabody Museum is the more poorly preserved, for only one or two of the numerous cross-veins figured by Tillyard are visible. As far as this specimen is concerned, the wing is identical with that of *P. inaequalis*. Tillyard's figure shows the wing much broader and shorter than I believe it actually is. The bend in R is more remote from the base of the wing than he has drawn it, and this is also true of the Cu-M Y-vein, which occupies the same position that it does in *inaequalis*. The arms of the "Y" are unequal, not equal as described by Tillyard, and I am convinced that the cross-vein which he has named the humeral is really another one of the cross-veins present in that area, the true hm being more basal. The basal part of the wing seems to be entirely missing, and its extension would give the wing the more slender habitus of *inaequalis*, with which it is probably synonymous.

Holotype.—No. 5061a, Peabody Museum; counterpart, No. 5061b, Cawthron Institute.

Protopanorpa Tillyard

Protopanorpa Tillyard, Amer. Journ. Sci., **11** (62), p. 151, 1926.

Fore wing.— Rather broad, with a well rounded apex, and a convex anterior margin; costal area somewhat broader than in *Permopanorpa;* Sc forked dichotomously twice, so that it has three terminal branches; R straight, with at least one pterostigmatic veinlet; Rs with 4–5 terminal branches; M with 6–7 branches; M1 unbranched, M2 forked, M3 simple or forked, M4 branched; Cu-M Y-vein with equal arms; cross-veins weakly formed. Hind wing and body unknown.

Genotype.— *Protopanorpa permiana* Till.

This genus was erected by Tillyard for two species, the genotype

and *P. pusilla*. As I have already indicated, however, *P. pusilla* is very different from what Tillyard supposed, and belongs to a separate family, described below.

Protopanorpa permiana Tillyard

Plate 3, fig 3; Plate 5, fig. 2

Protopanorpa permiana Tillyard, Amer. Journ. Sci., **11** (62), p. 152, 1926.

Fore wing.— Length, 5.5 mm.; greatest width, 2.0 mm.; distal branch of Sc terminating on the costal margin, at about the basal edge of the pterostigma; first and second branches of Sc oblique; Rs straight at the base, but diverging downward just beyond hm; R1 straight, diverging upward to the pterostigma from the lowest point in the bend of R; R1 with one pterostigmatic veinlet; Rs originating at the lowest point in the bend of R; first fork of Rs remote from the origin of Rs; R2+3 diverging before the pterostigma; R2 forked or simple; R4+5 separating just below the division of R2+3; R4 simple; R5 forked; M1-4 diverging from M5 before the origin of Rs; the fork on M2 is very deep; M3 is unbranched in most specimens, but may be forked slightly; M4 forks very close to the origin of M3; Cu1 slightly curved, its free piece distinctly arched; Cu2 straight, except at the distal part; 1A very close to Cu2 at the base, but remote distally; both 2A and 3A gently sigmoidal.

Holotype.—No. 5064 Peabody Museum, counterpart in Cawthron Institute; paratype No. 5065b in Peabody Museum, counterpart in Cawthron Institute. Two well preserved fore wings of this insect are present in the Harvard collection, numbers 3034ab and 3035ab (F. M. Carpenter).

It should be noted that Tillyard's figure of this wing differs from mine in having a slightly concave anterior margin, instead of convex, as I have drawn it. The type specimen, however, does not lie flat on the rock, but is much twisted and folded. The distal part of the wing, which was hidden by a bit of rock when Tillyard described it, is distinctly plaited or creased at the very apex. A careful examination of the wing shows also that R and Sc are plaited across the middle, as though the front margin had been bent inwards, and as a matter of fact, at the point of greatest concavity of the front margin the wing membrane actually overarches R1 from the anterior side. I am convinced therefore that the true shape of the anterior margin of the type wing was convex, as in the two Harvard specimens, which lie flat on the rock. These two specimens differ slightly in venation from each other and from the holotype. Specimen No. 3024ab possesses a small

fork on the end of M3, as shown in the figure, but this is undoubtedly an individual variation like that of some of the specimens of *P. inaequalis*. The structure of Rs in this specimen is just like that of the holotype, but in the other Harvard specimen R2 and R5 are forked, whereas R3 is simple. These are variations which have already been met in *P. inaequalis*, so that to make a new species for every difference in the branching of the sector would be as unjustified here as in *inaequalis*, since the indications are that *P. permiana* possessed as variable a sector as the former species. One of the interesting features of this wing is the double forking of the subcosta. As can easily be seen in the photograph these branches are dichotomous, not pectinate. This is certainly a very primitive character, only a little more specialized than the condition in the new family *Agetopanorpidae*, where the forking is even more pronounced. Both of the subcostal forks in *Protopanorpa* bear well developed macrotrichia.

Tillyard considered *Protopanorpa* to be directly ancestral to the Liassic *Orthophlebiidae*, which, in turn, gave rise to the recent *Panorpidae*. Whether Protopanorpa actually was ancestral to the orthophlebiids is a question which I do not believe can be answered until further details are known about this Permian genus, especially the venation of the hind wing.

Protochorista Tillyard

Protochorista Tillyard, Amer. Journ. Sci., **11** (62), p. 140.

Hind wing.— Anterior margin slightly convex, nearly straight; apex well rounded; costal space broad; Sc forked distally; pterostigma well developed, with one veinlet; Rs originating close to the base of the wing; Rs and M with 5 branches; M1, M3, and M4 unbranched; M2 forked. Cross-veins very weakly developed.

Genotype.— *Protochorista tetraclada* Till.

This genus was established by Tillyard for two specimens which he placed in different species, *P. tetraclada*, and *P. pentaclada*. After comparison of the types of these two species, I am convinced that they are synonymous.

Protochorista tetraclada Tillyard

Plate 5, fig. 1

Protochorista tetraclada Tillyard, Amer. Journ. Sci., **11** (62), p. 141.
Protochorista pentaclada Tillyard, Amer. Journ. Sci., **11** (62), p. 141.

Hind wing.— Length, 5.0 mm.; greatest width, 1.2 mm.; Sc terminating close to the base of the pterostigma; first branch of Sc oblique and

well developed; R with an abrupt bend at the base, just below hm; Rs originating distally of the lowest point in the bend; R1 straight; R2+3 diverging from R4+5 well beyond the origin of Rs; R2 unbranched; R3 forked or simple; R4 unbranched; R5 forked or simple; M uniting with Cu1+M5 before it joins with R; first division of M basally of that of Rs; M1 diverges from M2 distad of the separation of M3 and M4; Cu1 and Cu2 straight, a marked indentation at the termination of Cu2. Anal area is not known (in the figure the anal area of *P. inaequalis* has been sketched in to give some idea of the shape of the wing).

Holotype.—No. 5050, Peabody Museum. One specimen in the Harvard collection, No. 3036ab, is a well preserved wing, with the anal area missing.

Both of the specimens in the Yale collection are on a rough surface of the rock, and are consequently more or less distorted. Since the Harvard fossil lies quite flat and has no signs of distortion, it undoubtedly shows the true shape of the wing. I have examined the Yale specimens with much care, but cannot agree with Tillyard on several points. In specimen number 5055 the subcosta is distinctly forked, and terminates on the costal margin; R1 has an oblique pterostigmatic veinlet; R3 possesses a small terminal fork near the margin of the wing (the presence of this fork was ascertained by removing the piece of limestone which covered that part of the wing when Tillyard described it); there is absolutely no sign of the free piece of Cu1 which Tillyard has shown in his figure; and Cu1+M5 joins directly to the base of M. The wing is therefore identical with the one in the Harvard collection, with the exception of slight differences in the branching of the radial sector. The other Yale specimen, No. 5056 has a forked subcosta also, but just before this vein terminates on the costal margin it bends downward and touches R1, as shown in Tillyard's figure. This feature, however, can hardly be of specific importance, since in about 30% of the North American specimens of *Panorpa*, regardless of species, this same peculiarity can be found! In his figure of this specimen, Tillyard has shown more correctly the way in which Cu1+M5 joins the stem of M, although he has indicated the free piece of Cu1 by a dotted line. The specimen is consequently identical with the preceding, except for slight differences in the depth and arrangement of the forks on Rs. Since I have previously shown that Rs is an unstable vein in the other Permian Mecoptera, we are not justified in regarding *P. tetraclada* and *P. pentaclada* as distinct.

That all three of these specimens are hind wings is obvious at once

from the absence of the free piece of Cu1, and the characteristic manner in which Cu1+M5 joins to M. This is also shown by the short, abrupt bend in R and the origin of Rs close to the base of the wing. It seems strange that the hind wings of this species have been found without the fore wing, and one is naturally tempted to believe that the fore wing has been described as a separated genus. The only fore wing which might be thus connected is *Protopanorpa permiana*. This occurs at about the same frequency as *Protochorista*, and the two wings are about the proper size and shape; but in all known specimens of the former species M4 is deeply forked, whereas it is always simple in *Protochorista*. Regardless of this difference, however, I believe that these two species will become synonymous when a complete specimen of one of them has been found.

ANORMOCHORISTIDAE

This family was erected by Tillyard for a single wing, *Anormochorista oligoclada* Till., which is not represented in the Harvard collection. Although my examination of the type (No. 5068) convinces me that the peculiar shape of the hind margin is due to a fold in that part of the wing, the venation is so aberrant that the insect obviously had no place in the evolution of recent Mecoptera.

LITHOPANORPIDAE, new family

Minute insects, allied to the *Permopanorpidae*.

Fore wing.— Shape much as in *Permopanorpa*, costal space narrow; hm present; pterostigma well developed; R1 strongly formed, with several pterostigmatic veinlets; Rs with 4 branches, M with 6; Cu1+M5 well developed, unbranched; Cu-M Y-vein not perfectly formed, M5 being entirely absent as a free vain; Cu1 diverging from Cu2 at the very base of the wing, the free piece of Cu1 being extraordinarily long; Cu2 fused with 1A basally; 3 anal veins present; cross-veins few.

This family is the most highly specialized of any of the Permian Mecoptera yet known. The complete absence of the free part of M5 is a peculiarity found only in the highly developed recent forms, and the long free piece of Cu1 is not present in any known Mecopteran, fossil or recent.

Lithopanorpa, new genus

Fore wing.— Slender, rounded apically; anterior margin straight; Sc terminating on the costal margin well before the pterostigma, its

anterior distal branch reduced to a short veinlet; R1 straight, with 2 pterostigmatic veinlets; pterostigma elongate; M1 and M3 branched; M2 and M4 forked; basal part of M (between R and the union of M with Cu1) quite straight, appearing as a basal continuation of Cu1+M5.

Genotype.—Protopanorpa pusilla Till.

Lithopanorpa pusilla (Tillyard)

Plate **2**, fig. 4; Plate **5**, fig. 3

Protopanorpa pusilla Tillyard, Amer. Journ. Sci., **11** (62), p, 153.

Fore wing.— Length, 4.0 mm.; greatest width, 1.3 mm. Sc terminating at about the middle of the anterior margin; R straight at base, but curving gently downward just below hm; Rs originating at the lowest point in the bend of R, just beneath Sc1; first fork of Rs below the termination of Sc; R2+3 dividing close to the margin of the wing, the fork of R4+5 being much deeper; M makes a sharp bend at its junction with Cu1, so that the rest of the stem of the media seems to be a continuation of the free part of Cu1; first obvious fork of M distad of the origin of Rs; M1 diverges from M2 just below the basal part of the pterostigma; M3 separates from M4 basad of the first furcation of Rs; Cu1+M5 gently curved; Cu2 a straight vein; 1A fused with Cu2 for about half its length; 2A terminating on the hind margin, but linked with 1A distally by a strong cross-vein. Other cross-veins weakly formed.

Holotype.—No. 5066a, Peabody Museum; counterpart in Cawthron Institute.

When Tillyard described this specimen, the basal two-thirds of the wing was covered up by a fragment of limestone, although Tillyard was under the impression that this portion of the wing was obliterated by a fracture. With Dr. Dunbar's permission, I removed the small chip of rock, exposing the basal third of the specimen, which was utterly different from what Tillyard had assumed. The absence of M5 and the fusion of Cu2 and 1A are suggestive of a hind wing, since the former is a condition found in the hind wings of all known Mecoptera, and the latter, one that is constant in the hind wings of recent Mecoptera. But in all known hind wings of the Permian species (*Protochorista, Permopanorpa, Platychorista*) there are two constant features: the short bend in R at the base, and the basal origin of Rs. It will be seen in the photograph of *L. pusilla* that the bend in R and the origin of

Rs is precisely like those in the fore wing of the Permian forms, and not at all like the hind wing. Furthermore, the free part of Cu1 is very short and weakly developed in the hind wings, but in *L. pusilla* it is extraordinarily long and well developed. All things considered, it seems certain enough that the holotype of this species is a fore wing.

AGETOPANORPIDAE, new family

Small insects, remotely related to the *Permopanorpidae*.

Fore wing (?).— Broad, with a rounded apex; costal space very wide, but without the numerous veinlets of *Platychorista;* Sc remote from the costal margin, with several dichotomous forks; hm present; R well developed; R1 slightly undulated; pterostigma very weakly formed; Rs with 4–6 branches; M with 6 branches; Cu-M Y-vein well formed in some species, but incomplete in others; 2 anal veins present.

Within this family I place *Petromantis* Handl. and *Kamopanorpa* Mart., both from the Russian Permian, and the new genus, *Agetopanorpa,* from the Kansan beds. *Petromantis* was originally placed by Handlirsch in the family *Palcomantidae,* as a Permian orthopteran allied to the recent mantids. Martynov, however, having many additional specimens of related forms, recognized the group as mecopterous, and placed this genus and *Kamopanorpa* in the family *Permopanorpidae.* That these genera cannot be assigned to that family is evident from the very broad costal space, the deep branches of Sc, and the very different shape of the wing.

Agetopanorpa, new genus

Fore wing (?).— More or less oval, costal margin distinctly arched; distal branch of Sc terminating just before the pterostigmatic area; R parallel with Sc at base, but bending abruptly away just beyond hm.; pterostigmatic veinlets absent, Rs with 5 branches, R5 being forked; M1 and M3 unbranched; M2 and M4 forked; free piece of Cu1 absent, or at least strongly formed; Cu2 remote from Cu1+M5 at base; 1A and 2A free; cross-veins very weakly developed.

Genotype.—Agetopanorpa maculata, new species.

Fore wing (?).— Length, 9.0 mm.; greatest width, 4.0 mm. Costal space narrowed at base; Sc2 longer than Sc1; R1 diverging from Rs just below the first fork of Sc; first fork of Rs well beyond the second fork of Sc; R2+3 and R4+5 divide shortly after their origin and at

about the same level; the fork of R5 is rather deep; M1-4 diverging from Cu1 basally of the origin of Rs; first apparent fork on M just a little before the first fork in Rs; M1 about as long as M3; fork on M2 shorter than that on M4; Cu1+M5 very slightly sigmoidal; Cu2 curved at its ends, but straight for most of its length; 1A fused with Cu2 at the very base; hind margin of the wing with a distinct indentation at the termination of Cu2. The entire wing is covered with irregular brown pigment spots, somewhat larger and more diffuse apically.

Holotype.—No. 3037ab, Museum of Comparative Zoölogy; collector, J. W. Wilson.

This wing, although magnificently preserved, is one of the most puzzling of any of the Permian Mecoptera. That it is a Mecopteran is unquestionable; the structure of R1, the radial sector, and particularly the media, which is identical with that of *Protopanorpa*, place it definitely within the order. But the complete absence of the free piece of Cu1 at the base of the wing is a character which has not been found in any other Mecopteran, fossil or recent. The veins stand out with striking clearness and are marked with the large bases of the macrotrichia, so characteristic of the ancient Mecoptera (see photograph, Plate 2, fig. 1). That the free piece of Cu1 could have been present in this wing, yet not preserved, seems to be utterly impossible. Nevertheless, Cu1 does actually make up a major part of the vein labeled Cu1+M5 in the figure, as shown by the convexity and concavity of the veins. M5, alone, would be a weak, concave vein, but in the fossil Cu1+M5 is a strong, convex vein as in all other Mecoptera. We are therefore forced to the conclusion that the free part of Cu1, which ordinarily forms the lower arm of the "Y", has been lost in *Agetopanorpa*. Only one of the Mecoptera of the Russian Permian, *Petromantis kamensis*, Mart., is completely enough preserved to show the base of the wing, and this was described by Martynov as having the Cu-M Y-vein completely formed. The absence of the free part of Cu1 in *Agetopanorpa* is therefore even more perplexing, for in other respects *these two wings are identical, in size, shape, and venation*, except for the fork of R5 in the Russian form. In view of the phylogenetic significance of the Cu-M Y-vein in the Mecoptera, one would be justified in establishing a separate family for *Petromantis*, if it were not for this startling similarity between it and *Agetopanorpa*. It is hardly conceivable that these two wings can be so much alike in other respects, and yet belong to distinct families. There is, of course, the possibility that *A. maculata* is a hind wing, and *P. kamensis*,

a fore wing. But as I have pointed out in the case of previous species, the origin of Rs in the hind wing is much closer to the base than it is in the fore wing, and in *A. maculata* Rs originates in a manner quite characteristic of a fore wing, and just as it does in *Petromantis*. The explanation of the structure of the cubitus of *Agetopanorpa* will probably become clear enough when additional material has been found, and until then it hardly seems necessary to establish a new family for the Russian form.

There is one other feature of this wing that is peculiar. The vein labeled Cu2, which is distinctly concave, is entirely without the macrotrichia so prominent on the other veins (this absence of macrotrichia can be noted in the photograph). At first I suspected that this apparent vein was only a fold in the wing, but since the next anal vein in the wing is strongly *convex*, and hence must be 1A, the concave vein between 1A and Cu1 must be Cu2. One would naturally suppose that since the macrotrichial bases and color markings are so clear all over the wing, the cross-veins would also be evident; but not one, except hm, is discernible. A wing of this size and shape, however, would be exceedingly flimsy without cross supports, and we must assume that some cross-veins were there, although poorly developed.

The systematic position of *Agetopanorpa* is very obscure. The broad costal area, the well developed branches on Sc, and the 6-branched media, are all primitive characters; in fact, the structure of Sc is probably more primitive than that of any other known Mecopteran. But the loss of the basal piece of Cu1 is a high specialization which eliminates the genus from the line of ancestry of our recent forms, and we must conclude that *Agetopanorpa* represents a well developed end branch of some primitive Mecopteran not known to us at present. It seems probable that the *Agetopanorpidae* was a very ancient family, which also existed during the earlier Permian, or perhaps the Upper Carboniferous, and that *Agetopanorpa* was a Permian survival that had reached a high stage of development along certain lines. The relatively high degree of specialization which some of the Lower Permian Mecoptera seemed to have attained is conclusive proof that this order had been in existence for a long time previous to the Wellington age. But whether these insects arose in the earliest Permian or in the Upper Carboniferous, as Tillyard claims, is a question which cannot be answered with any certainty until more has been learned of the fauna of the Pennsylvanian.

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By Thomas Barbour

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No. 3.— *The Anoles. I. The Forms Known to Occur on the Neotropical Islands*

By Thomas Barbour

For several years, my friend President Alexander G. Ruthven and I have lived in the hopes that some day we would write together a monograph of this pestiferous genus. This project, by force of circumstances, must now be postponed. While he has seen many of the types at home and abroad, he feels, and I wholly agree, that we know too little as yet of the species of northeastern South America especially, to make an adequate general survey at the present time. Moreover, new responsibilities have given us both less and less time for study of the literature and examination of such material as is now available. Inadequate though it is, this is already a large accumulation. I have, therefore, with his approval, decided to bring out this critical list of the insular species. A few more of these will be described, but compared with the mainland forms, our knowledge is reasonably complete.

A long awaited opportunity to see the Lesser Antillean forms in life was offered me by Mr. Allison V. Armour who, with princely generosity, took me to no less than twenty different islands which I had not visited before on my many previous journeys to the Caribbean area. Thus the opportunity offered to see that *Anolis roquet* and *Anolis luciae* can be distinguished easily in life from one another and from *Anolis vincentii*, although with alcoholic material these particular species are decidedly difficult to separate. The chance that I shall see many more Antillean forms is remote, and so this little paper is offered with the hope that it may be of service to those who are interested in the zoölogy of this fascinating area. The few scattered insular species which occur outside the Caribbean basin are included here also. Thus the mainland forms are left for a later day.

Since boyhood — for I collected my first West Indian Anoles when fifteen years old — I have been interested in this perplexing genus, collecting material, securing photographs of typical specimens, locating these wherever possible. Some types are lost, unfortunately often of ill-described species, and these have been put into the most probable synonymy. This list gives an idea, up to date, of the number of recognizable species known to occur on the Neotropical Islands. Only a few of the most important references are given but many important changes in the synonymy will be found since Boulenger, in the Catalogue of

Lizards in the British Museum, **2**, 1885, made his attempt at a general treatment of the genus, and some since I reviewed the genus in a general faunistic paper in 1914 (Mem. Mus. Comp. Zoöl., **44**, 1914, p. 272–295). A complete lack of knowledge of the animals in life and most inadequate material made Boulenger's attempt a poor effort at best. As I have said, it has been my great good fortune to have seen most of these forms in life and some of the accounts of distribution, abundance, etc., are based on field observations over many years. The work has been aided by the generous kindness of many colleagues. It is impossible to mention them all, a catalogue of most of the herpetologists would result, and to mention some and not others would be unjust. Suffice it to say that each and every one has aided in supplying all possible information concerning the material in his care.

Special exception must be made in the case of Dr. Leonard Stejneger who, with characteristic generosity, turned over many notes concerning synonymy of the West Indian forms. These he had made during many European journeys and they have been of the utmost value.

The first volume of Dr. Boulenger's Catalogue of the Lacertidae appeared about the time this task was begun. Nothing could be more impressive than the absolutely opposite conditions which are shown by the Lacertae of the Old World and the Anoles of the New. The Lacertae comprise a group composed of vigorous, active, diurnal species probably still in active extension of an enormous range, one that contains species of vast distribution and broken up into a great series of ill-differentiated variants which generally do, but occasionally do not, bear a relation to the locality in which they occur. Thus a number of "varieties" of *Lacerta muralis* occur together in many localities in Italy, Corsica, and Sardinia in a perfectly haphazard manner. This betokens a plastic condition and is evidence of a species which, while still varying actively, has not yet come to have definitely fixed place modes. Other species of Lacerta have become well defined in specific characters and in geographic limitations.

In Anolis we find a very different condition of affairs. The species are generally capable of definition and have definite boundaries and no tendency to break up into many "varieties" in any given locality. To the eye there appears to be very great variability, but where this is observed, we find a species of many and often very rapid color changes. *Anolis ordinatus*, in the Bahamas, may be black with tiny specks, uniform mouse gray, gray with zebra markings, or with dorsal rhombs, changing quickly from one phase to the other. Another species, like *Anolis alutaceus*, may have apparently little or no facility of meta-

chrosis whatever. In spite of this, such a form as *Anolis carolinensis* Voigt, which has a vast range, shows no signs whatever of breaking up into geographic races, nor do "varieties" occur in any given locality. So also with the other mainland species with which we are familiar and some of which have very narrowly limited ranges. That *A. carolinensis* has been upon the continent for a long solitary life is shown by the fact that its relatives on Cuba (*porcatus*), Navassa (*longiceps*), Cayman (*maynardii*), Haiti (*chlorocyanus*), Ruatan (*allisoni*), and in the Bahamas (*brunneus*) are all very strongly defined forms and their differentiation is surely an indication that they have been isolated for some considerable period of time. It is possible that *carolinensis* reached the mainland of North America originally as a waif from the West Indies, and it is even more similar to *brunneus* than to any of the other forms. It is, however, equally probable that the *carolinensis* stock once existed widespread on the continent and then disappeared. Its persistence on Ruatan, a continental island, is evidence in favor of this view.

The Antillean Anoles

The series of Antillean species offers a rather contrasting state of affairs to that on the continent. There are only a very few old names about which uncertainty exists, such as *Anolis bullaris* (Linné) and *Anolis richardi* (Duméril and Bibron), for most of the forms hail from islands and topotypes may be easily secured. Cope, to be sure, described a few species, such as his *Anolis homolechis*, from specimens without a locality, and others have most unfortunately done likewise; but very many species, notably those described by Garman and Stejneger, and many described by Cope, were based upon material so collected as to fulfil modern requirements of precision regarding data and history. As with most of the genera of Antillean reptiles and amphibians, I have been fortunate in the material available in the Museum of Comparative Zoölogy. Thus there are, roughly, about ninety species which are probably worthy of specific rank, and of these, eighty are represented in this collection and among these are nearly thirty types of valid forms and also the types of several synonyms. A number of the species are represented by from forty to one hundred specimens, so that in most cases material has been ample.

No single citation can exhibit more clearly the change of opinion in taxonomy as applied to this group than to note what Günther said in the Zoölogical Record for 1887 (p. 10) concerning Garman's proposal to multiply the Antillean species. Garman, as Alexander Agassiz's as-

sistant on the Blake, had seen the Anoles in life, in most cases. Günther knew them only as preserved museum specimens. His eye was not cultivated by field experience and most unfortunately Boulenger suffered under the same handicap. Cope made up for his lack of opportunity to observe the living forms by his uncanny taxonomic insight.

For the sake of comparison I add here Günther's reduction of Garman's proposals to "more comprehensive terms." As now known Garman's species were generally strikingly distinct and most of them stand valid today by universal agreement. Günther's remarks follow: "S. Garman, Bull. Essex Inst. xix, has greatly multiplied the binomials of the West Indian forms of this genus. The RECORDER would refer the new species and varieties to the following more comprehensive terms: 1, A. cristatellus, D. & B.; A. scriptus, n. sp., p. 28, Silver and Lena Keys, Florida. 2, A. gingivinus, Cope: A. virgatus, n. sp., p. 41, St. Bart's. 3, A. leachii, B. & D.: A. asper, n. sp., p. 31, Marie Galante, nubilus, n. sp., p. 32, Redonda, sabanus, n. sp., p. 39, Saba, speciosus, n. sp., p. 42, Marie Galante, lividus, n. sp., p. 43, Montserrat. 4, A. alligator, D. & B.: A. gentilis, n. var., p. 34, Petit Martinique, cinereus, n. var., p. 35, Grenada, extremus, n. var., p. 35, Barbados, luciae, n. sp., p. 44, St. Lucia, vincentii, n. sp., p. 46. St. Vincent. 5, A. richardii, D. & B.: A. griseus, n. sp., p. 36, St. Vincent, and trossulus, n. sp., p. 38, Grenada. Also copious notes on other known species. A. conspersus, n. sp., id. P. Am. Phil. Soc., xxiv, p. 273, Grand Cayman, W. Indies (=A. grahamii, Gray. REC.)"

Some species of Anolis simply swarm; no mainland species of this genus approach in abundance *Anolis sagrei* in Cuba or *Anolis ordinatus* in the Bahamas. At times these may be seen literally on every fence post, tree trunk and hut wall. They never completely disappear no matter how dry the season, but they grow uncommon, and then with the oncoming of the hot spring rains they simply swarm. Some species disappear completely with drought, as *A. spectrum*, others grow excessively rare, as *A. alutaceus*, while others again show no appreciable change in abundance as *A. lucius*. It may be said, however, that Anoles are far rarer during long droughts than during rainy weather, and had my many trips to the West Indies been made more often in summer instead of in our winter, which is the dry season in most of the islands, as by force of circumstances they had to be, I might have rediscovered *A. spectrum*. This good fortune was reserved for Dr. E. R. Dunn. Moreover, I would have seen other species abundantly which I now naturally think of as rare. Still even when Anoles seem scarce, if one will but choose some woodland glade, preferably near a running

stream, and there break apart and strew about one of the great termite nests so common in Cuba and then sit still, from all sides Anoles will appear. What calls them is hard to say. The faint scratching of the myriad insects may be heard, or there may be a faint odor from the broken termitarium, but be that as it may, many sprightly little lizards will soon be pounding and shaking and chewing the tasty morsels, while ever and anon some old male will push up on his forefeet, raise his chin and bob his head like a mechanical toy while his dainty fan of vivid colors is displayed for the benefit of whoever may care to watch him.

The vast majority of the species are arboreal and it is this fact which explains why these lizards persist even where the mongoose abounds.

Most of the species lay single relatively large, leathery, rather oblong eggs, usually in some punky cavity of a hollow stump or limb. One species (*A. lucius*) lays a brittle chalky white egg or group of two or three stuck fast to the limestone cave-walls or crannies to which this species is confined.

Within and about our laboratory, Harvard House, at Soledad, Anoles are frequent visitors. Some visit the dining room for the ever-present ants of the tropics and soon learn to jump for tiny crumbs of bread or bits of cheese. Others prefer the window screens, no doubt garnering a fair feast of flies and other winged creatures which buzz drearily about during the hot, still days, no matter how carefully the house is screened.

Work done at Harvard House by Hadley, and elsewhere by others has gone far toward elucidating the apparent mysteries of metachrosis. This fascinating phase of the study of the Anoles I cannot attempt to review here, but the works of Parker, Staratt, Carlson, Strecker and Hadley are well worth the examination of anyone who wishes to know, as much as may be, these the loveliest of all lizards.

Specific Interrelationships

Some of the Greater Antillean species have gone through an evolution through isolation which has so differentiated them that no evident allies may be named. *Anolis loysiana* is an excellent example. This condition is not the rule. In the Lesser Antilles two stocks supply the pair of species which is the normal insular quota. Thus *A. wattsi* and *A. antiquae* offer a typical condition. The small, smooth, depressed, usually rupicolous form with characteristically subdued coloration and the large, rough headed, arboreal, gaily decorated type are a typical pair. For instance on Saba, a representative of the first type

appears while on Grenada, St. Vincent, Antigua, St. Kitts, Nevis, St. Eustatius, Marie Galante the typical pair of species is present. On Redonda and Desirade the single species represents the second category mentioned, while on Guadeloupe, Martinique and Dominica the sole existent form is of the first series mentioned above. The Anole now on the verge of disappearance in Barbados is apparently absolutely the same as one of the common species of Trinidad and may have come from there originally by fortuitous human agency. Tobago shows an anomalous condition, for its fauna in general is markedly continental in type, like that of Trinidad, but the Anole found in Tobago is indistinguishable from *Anolis richardii*, the large species occurring upon Grenada, but not upon the Grenadines where only the lesser type is found. Grenada has on the other hand a number of mainland species and the situation there is characteristic of a borderland zone. Here between the typical Antillean and Continental provinces a mixed-up condition is found to exist such as that to which I have called attention as characteristic of certain islands in the East Indies on the border between the Indonesian and Papuasian provinces. (Mem. Mus. Comp. Zoöl., **44**, 1912, p. 28 et seq.)

I cannot tie these two stocks with much confidence to any of the Greater Antillean groups of species. They surely recall *A. aeneus* and *A. chrysolepis* of Trinidad which brings them near to South America, while I can but suggest their possible relationship with *Anolis cristatellus* of Porto Rico and perhaps *A. gundlachi* of the same island. I prefer for the present to consider this more a possibility than a probability. The Virgin Islands represent in a minor degree again a borderland zone where some mixture of types and confusion exists, only here the transition is between the relatively rich Greater Antillean and the relatively depauperate Lesser Antillean provinces.

It may be noted also that one series of related species can be pointed out which bridges neatly over the region between the greater and lesser islands. *Anolis krugi* of Porto Rico, *Anolis acutus* of St. Croix and *Anolis wattsi* of the Leeward Islands, form, I think, quite surely a closely related chain of vicarious forms.

Within the Greater Antilles several stocks may be distinguished with representative species on the major islands. The *A. porcatus* group has been mentioned. Schmidt has suggested as a series of related forms *A. iodurus* (Jamaica), *A. chlorocyanus* (Haiti) and *A. evermanni* (Porto Rico). I believe that *A. chlorocyanus* is probably of the *porcatus* series and suggest *coelestinus* as the Haitian representative of this branch. This occurrence of forms in Haiti derived from the past independent

connections with Cuba at one time and with Jamaica at another is highly characteristic.

No one of the cursorial, herbicolous types of Anolis occur in Jamaica while three occur in Haiti or as I should often say Hispaniola. In Cuba two such types are found while another *A. pulchellus* occurs in Porto Rico and in most of the Virgin Islands. If we could conclude that *Norops ophiolepis* were really an Anole most highly modified for cursorial life, we would have then three stocks of this style in Cuba, as in Haiti, and one passed on to the eastward islands, but the Cuban Norops with its short blunt skull and fixed coloration does not seem allied to this generally long headed series. It must be admitted, however, that color changing is not characteristic of any of these terrestial species which I know.

These notes could be considerably expanded. The *A. alliaceus*, *A. dominicensis* and *A. distichus* series has been mentioned elsewhere in this paper. So also the *A. sagrei*, *A. ordinatus*, *A. cybotes* series and others could be added. Allied representative forms occur in the great island of Cuba as *A. mestrei* in Pinar del Rio, *A. ahli* in Sta. Clara and *A. allogus* in Oriente.

I think enough has been said to show that while some anomalies as yet unexplainable occur, in general the Anoles have an orderly and not a haphazard distribution in the West Indian area. This bespeaks distribution by land connections caused by past differences in the relation of land and sea level and such a distribution by its very nature cannot as a whole be the result of fortuitous dispersal. Nevertheless, I believe that a few cases of chance dispersal may have occurred.

The Cayman Island species are probably waifs. The Navassa Island species are with at least equal probability relicts surviving on the remnant of an ancient land bridge. I hope that some day I may present the results of field observations on the Porto Rican species, as well as a greater familiarity with the Haitian forms. Perhaps some time another chance to land upon Navassa may come, upon a calm day.

Throughout the paper obsolete and synonymous names appear in *italics*.

Anolis abatus Ahl, Arch. f. Naturg., **90**, 1924, p. 248 (type locality, Cuba; type in Berlin Museum, Gundlach coll. ♂ holotype by subsequent designation, the ♀ cotype being certainly *Anolis ahli* Barbour).

The validity of this species is much in doubt. The parts of the island in which Gundlach collected are mostly very well known now and this is probably the synonym of some well known species. We strongly suspect its identity with *Anolis mestrei* Barbour and Rams-

den, and the type must be examined by a specialist on the genus before it can be definitely allocated to the synonymy.

Anolis acutus Hallowell, Proc. Acad. Nat. Sci. Phila., 1856, p. 228 (type locality, "Cuba?"; type in Phila. Acad.; origin unknown). Cope, Proc. Acad. Nat. Sci. Phila., 1861, p. 209 (Santa Cruz, W. I.; Smithson. Inst., Riise coll.). Reinhardt and Lütken, Vid. Med. Nat. Foren. Copenh., 1862 (1863), p. 252; extr. p. 100 (St. Croix). Bocourt, Miss. Scient. Mexique, Zoöl., Rept., livr. **2**, 1873, pl. 15, fig. 2. Boulenger, Cat. Liz. Brit. Mus., **2**, 1885, p. 36 (St. Croix). Barbour, Mem. Mus. Comp. Zoöl., **44**, 1914, p. 284 (St. Croix).

Of the present species we have no recent information to counter-indicate that it is still an abundant species.

Anolis aeneus Gray, Cat. Liz. Brit. Mus., 1845, p. 205 (type locality "Tropical America"; type in Brit. Mus., Thos. Bell coll.). Ruthven, Occ. Pap. Mus. Zoöl. Univ. Mich., no. 143, July 9, 1923, p. 6 (type examined is the Trinidad form, crit.).

Anolis trinitatis Reinhardt and Lütken, Vid. Meddel. Kjobenk., 1862 (1863), p. 269 (type locality, Trinidad; types in Copenhagen Mus. Riise coll.). Garman, Bull. Essex Inst., **19**, 1887, p. 35 (Sept., p. 11). (Color in life.) Barbour, Mem. Mus. Comp. Zoöl., **44**, 1914, p. 281 (crit. syn.).

Anolis alligator Cope, Proc. Amer. Phil. Soc., **18**, Aug. 11, 1879, p. 276 (Tobago).

Anolis extremus Garman, Bull. Essex Inst., **19**, 1887, p. 356; Extr., p. 11 (type locality, Barbados, B. W. I., types in Mus. Comp. Zoöl., 6,183; Garman coll.; cotypes 39,290–91 in U. S. Nat. Mus.). Barbour, Mem. Mus. Comp. Zoöl., **44**, 1914, p. 278 (crit.).

Anolis alligator Fielden, Zoölogist, (3), **13**, Aug. 1889, p. 297 (Barbados) (not of Duméril and Bibron).

Anolis biporcatus Mole and Urich, Trin. Field Naturalists Club, **2**, 1893, p. 80.

This species is said to be common and widespread in Trinidad. I did not see many, however, during a recent visit of several days' duration. It is almost if not quite extinct on Barbados. It is easily separ-

able from *A. vincenti* and *A. luciae* in having smaller and more rugose, less pavement-like scales on the front and a strongly mottled coloration.

Anolis ahli Barbour, Occ. Papers Boston Soc. Nat. Hist., **5**, June 24, 1925, p. 168 (type locality, Hydroelectric plant, Trinidad Mts., near Soledad, Cienfuegos, Cuba; type in Mus. Comp. Zoöl., 19,905, E. R. Dunn coll.).

Professor E. R. Dunn and a number of other naturalists while studying at the Harvard Biological Laboratory and Botanic Garden (Atkins Foundation) at Soledad near Cienfuegos, Cuba, have visited the damp woodlands near San Blas and Buenos Aires in the mountain road from La Sierra to Trinidad. This species occurs in these highlands in fair abundance. It has not been found elsewhere. It is related to *Anolis mestrei* Barbour and Ramsden, living under similar conditions, though somewhat lower, in the Sierra de Guane, Prov. Pinar del Rio.

Anolis agassizi Stejneger, Bull. Mus. Comp. Zoöl., **36**, 1900, p. 161, pl. (type locality, Malpelo I. Pacific coast of Colombia; type U. S. Nat. Mus., 22,101; Chas. H. Townsend con. Albatross Exp., two paratypes in Mus. Comp. Zoöl.).

Apparently abundant on this great rock, Malpelo is almost unscalable and the types were collected from a boat. Mr. Slevin, however, of the California Academy of Science has landed recently and collected most successfully upon this extraordinary island.

Anolis alliaceus Cope, Proc. Acad. Nat. Sci. Phila., 1864, p. 175 (type locality, unknown; type in Brit. Mus.). Günther, Ann. Mag. Nat. Hist., (6), **2**, Nov. 1888, p. 363 (Dominica). Barbour, Mem. Mus. Comp. Zoöl., **44**, 1914, p. 275 (crit.).

Xiphosurus oculatus Cope, Proc. Amer. Philos. Soc., **18**, 1879, p. 274 (type locality, Dominica, W. I.; types in U. S. Nat. Mus., 10,139, coll. Ober.).

Anolis oculatus Garman, Bull. Essex Inst., **19**, 1887, p. 30; extr. p. 6 (Dominica).

Anolis leachii Boulenger, Cat. Liz. Brit. Mus., **2**, 1885, p. 29 (part; Dominica; not of Duméril and Bibron). Verrill, Trans. Conn. Acad., **8**, 1892, p. 352; extr. p. 38 (Dominica).

This Anole seemed rare in February, 1929 in the Botanic Station grounds and but few were seen, though the local Ameiva swarmed. Much rain was falling daily and conditions were perfect. The male may be black, finely spotted with green, or green with black ocelli, two on each side. The dewlap is yellow. Up at Sylvania (alt. 2,000 ft.) it seemed even less common along the road, and uncommon there.

Anolis allisoni Barbour, Proc. New Eng. Zoöl. Club, **10**, July 26, 1928, p. 58 (type locality, Coxen Hole, Ruatan Island, Honduras; type in Mus. Comp. Zoöl., 26,725; T. Barbour coll.).

I have referred at length to the abundance and relationships of this beautiful and important species in the original description.

Anolis allogus Barbour and Ramsden, Mem. Mus. Comp. Zoöl., **47**, 1919, p. 159, pl. 10, fig. 2 (type locality: Bueycito, near Bayemo, Oriente, Cuba; coll. de la Torre, Barbour and Rodriguez; type in Mus. Comp. Zoöl., 8,544).

Anolis angusticeps Barbour, Mem. Mus. Comp. Zoöl., **44**, 1914, p. 292 (not of Hallowell).

Anolis mertensi Ahl, Zoöl. Anz., **62**, 1925, p. 86 (type locality, Cuba; type a ♂ in Berlin Mus., Gundlach coll.).

This species has been found in the moist woods of the Sierra Maestra. It has also been shown by Dr. C. T. Ramsden and T. Barbour to have a wide distribution in the mountains about the Guantanamo Basin. It is a fine and handsome species.

I have a photograph of the type of *Anolis mertensi* Ahl, and believe that it belongs here.

Anolis (Dracontura) alutaceus Cope, Proc. Acad. Nat. Sci. Phila., 1861, p. 212 (type locality, Monte Verde, Cuba; type in Smithson. Inst., 5,737½; coll. Wright).

Anolis alutaceus Gundlach, Contrib. Erp. Cubana, 1880, p. 49 (Cuba). Boulenger, Cat. Liz. Brit. Mus., **2**, 1885, p. 71. Barbour, Mem. Mus. Comp. Zoöl., **44**, 1914, p. 292 (crit.; distr. in Cuba). Barbour and Ramsden, Mem. Soc. Poey Havana, **2**, 1916, p. 135. Stejneger, Proc. U. S. Nat. Mus., **53**, 1917, p. 271 (distr.). Barbour and Ramsden, Mem. Mus. Comp. Zoöl., **47**, 1919, p. 153, pl. 9, fig. 1 (desc., crit.; Cuba).

This delicate wraith of a lizard is widely distributed, nowhere very common, but may be found in the lowland "manigua" or scrubby woods almost anywhere. It may be secured during the dry season but more easily during the rains.

Anolis augusticeps (*Lapso calami*) Hallowell, Proc. Acad. Nat. Sci. Phila., 1856, p. 228 (type locality, Cienfuegos, Cuba; type in Mus. Phila. Acad.; coll. Capt. Baker). (Obvious misprint for *angusticeps*).

Anolis angusticeps Gundlach, Contrib. Erp. Cubana, 1880, p. 45 (Matanzas, Cardenas). Boulenger, Cat. Liz. Brit. Mus., **2**, 1885, p. 11, footnote. Barbour and Ramsden, Mem. Soc. Poey Havana, **2**, 1916, p. 133. Stejneger, Proc. U. S. Nat. Mus., **53**, 1917, p. 272 (Isle of Pines). Barbour and Ramsden, Mem. Mus. Comp. Zoöl., **37**, 1919, p. 135.

This rather flattened pallid species seems to be rare everywhere in Cuba but less so on the Island of Pines. It frequents the trunks of royal palms and other trees having whitish or grayish bark.

Anolis antiquae Barbour, Proc. Biol. Soc. Wash., **28**, 1915, p. 74 (type locality, St. John, Antigua, Wulsin and Noble coll.; type Mus. Comp. Zoöl., 10,624).

Anolis leachii Boulenger, Ann. Mag. Nat. Hist., (6), **14**, 1894, p. 375 (Antigua only).

This splendid great Anole is common and distinct. Rich golden green with dark brown spots, a brown tail and a small pale yellow dewlap, i.e., yellow scales on white skin. The brilliant yellow skin about the eye is a fine field mark for males, females and young.

Anolis (Gastrotropis) argenteolus Cope, Proc. Acad. Nat. Sci. Phila., 1861, p. 213 (type locality, Monte Verde, Cuba; type in Smithson. Inst., 5,737¾; coll. Wright). Bocourt, Miss. Scient. Mexique, Zoöl., Rept., livr. **3**, 1874, pl. 14, fig. 12. Gundlach, Contrib. Erp. Cubana, 1880, p. 45. Barbour, Mem. Mus. Comp. Zoöl., **44**, 1914, p. 285 (crit., distr., sep. from *lucius*). Barbour and Ramsden, Mem. Soc. Poey Havana, **2**, 1916, p. 134. Stejneger, Proc. U. S. Nat. Mus., **53**, 1917, p. 270, figs. 49–51. Barbour and Ramsden, Mem. Mus. Comp. Zoöl., **47**, 1919, p. 140, pl. 14, fig. 6 (descr., crit.; distr. in Cuba).

Found on tree trunks, on old board buildings and less often on limestone rocks. Its western representative *Anolis lucius* D. and B., is more common from Santa Clara to Pinar del Rio but is always found on limestone cliffs where, according to Dr. Dunn, its eggs may be found stuck to the rocks singly or in pairs after the manner of certain species of Geckos.

Anolis (Acantholis) argillaceus Cope, Proc. Acad. Nat. Sci. Phila., 1862, p. 176 (type locality, Monte Verde, Cuba; type in U. S. Nat. Mus., 5,098; Chas. Wright coll.). Gundlach, Contrib. Erp. Cubana, 1880, p. 52 (Mt. Yateras, Guantanamo). Barbour, Mem. Mus. Comp. Zoöl., **44**, 1914, p. 291 (crit., distr.; Cuba). Barbour and Ramsden, Mem. Soc. Poey, Havana, **2**, 1916, p. 135; Mem. Mus. Comp. Zoöl., **47**, 1917, p. 147, pl. 7, fig. 6 (crit., distr.; Cuba).

So far as known Dr. Ramsden is the only person who in recent years, has succeeded in finding this lizard. He has found it on the coffee trees of plantations in the mountains about the Guantanamo Valley.

Anolis asper Garman, Proc. Essex Inst., **19**, 1887, p. 31; extr. p. 7 (type locality, Marie Galante, West Indies; types in Mus. Comp. Zoöl., 6,182; coll. Richardson; cotypes, 39,293–94, U. S. Nat. Mus.). Barbour, Mem. Mus. Comp. Zoöl., **44**, 1914, p. 276 (crit.).

This magnificent form with its high crested tail was abundant last February when I visited the places and a fine series was secured. It is an arboreal form, frequenting the tall mango trees — which are about the only tall trees there are, since this island is so completely cleared for sugar cane. The males are bright green or brown with a large dewlap, which is lemon yellow about a wide margin and pale dove gray at base and center. The females are uniform pale gray or light brown, unmarked.

Anolis barbudensis Barbour, Occ. Papers Mus. Zoöl. Univ. Mich., no. 132, Feb. 10, 1923, p. 4 (type locality, Barbuda, British West Indies; type, Mus. Comp. Zoöl., 16,167, coll. W. R. Forrest of Antigua).

Known from type only.

Anolis (Lacerta) bimaculata Sparrman, Nya Handl. Sv. Vet. Akad. Stockh., **5**, 1784, p. 169, pl. 4, fig. 4 (type locality, St. Eustatius; type in Mus. de Geer, Roy. Acad. Stockholm; Acrelius don.).

Anolis edwardsii Merrem, Syst. Amph., 1820, p. 45 (type locality, Nevis Is., West Indies, based on Edwards, Glean. Nat. Hist., t. p. 74, pl. 245).

Anolis bimaculata Garman, Bull. Essex Inst., **19**, 1887, p. 29; extr. p. 5 (St. Kitts).

Anolis bimaculatus Anderson, Bih. Sv. Vet. Akad. Handl. Stockh., **26**, afd. 4, no. 1, 1900, p. 27 (types, 3 specimens; St. Eustatius). Barbour, Mem. Mus. Comp. Zoöl., **44**, 1914, p. 279 (St. Kitts, Nevis; crit.); Occ. Papers Mus. Zoöl. Univ. Mich., no. 132, Feb. 10, 1923, p. 3 (crit., distr.).

Observed very abundantly by me in Feb. 1929, on both St. Kitts and Nevis where its arboreal habits protect it from the mongoose which abounds on both islands. The adult males are grass green or lighter, and may be speckled with dark brown especially on the tail. They may also be wholly dark brown except the upper lip, the throat, dewlap, and venter lemon yellow. The female is usually green with mauve gray dorsum and two wide yellow lateral lines.

Anolis bonairensis Ruthven, Occ. Pap. Mus. Zoöl. Univ. Mus., no. 143, July 9, 1923, p. 4 (type locality, Seroe Grande, $4\frac{1}{2}$ km. N.E. of Kralendijk, Bonaire, Dutch W. I.; (type Univ. of Mich. Mus. 57,221; H. Burrington Baker coll.), id. 152, Aug. 12, 1924, p. 29 (distr.).

I have not seen this species in life.

Anolis bremeri Barbour, Mem. Mus. Comp. Zoöl., **44**, 1914, p. 288 (type locality, Herradura, western Cuba, T. Barbour coll.; type in Mus. Comp. Zoöl., 7,889). Barbour and Ramsden, Mem. Soc. Poey Havana, **2**, 1916, p. 135; Mem. Mus. Comp. Zoöl., **47**, 1919, p. 144, pl. 6, fig. 5.

This very distinct and striking species is known only from the adult male type taken on the thatched roof of a house at Herradura in the Province of Pinar del Rio.

Anolis brunneus Barbour, Proc. Biol. Soc. Wash., **23**, 1910, p. 99 (crit. and relation with *porcatus* and *carolinensis*); Mem. Mus. Comp. Zoöl., **44**, 1914, p. 294 (crit.).

Anolis principalis var. *porcatus* Cope, Proc. U. S. Nat. Mus., **10**, 1887, p. 437 (part; Abaco, Bahamas).

Anolis principalis brunneus Cope, Proc. Acad. Nat. Sci. Phila., 1894, p. 432, pl. 10, fig. 3 (type locality, Crooked Island, Bahamas; type in Acad. Nat. Sci. Phila.; coll. Moore).

Anolis porcatus Barbour, Bull. Mus. Comp. Zoöl., **46**, 1904, p. 55 (Bahamas). Stejneger, the Bahama Islands, 1905, p. 332 (Bahamas). Rosén, Lunds Univ. Aarsskr., N. F. (2), **7**, art. 5, 1911, p. 30 (Bahamas).

A common species most often seen on Pandanus, Agave, Musa and similar plants. Common about gardens and often coming on the verandas of houses in search of ants, small spiders and other insects.

Anolis chloro-cyanus Duméril and Bibron, Erp. Gén., **4**, 1837, p. 117 (type localities, S. Domingo and Martinique; types in Paris Museum). Duméril, Cat. Méth. Rept. Mus. Paris, 1851, p. 57. Reinhardt and Lütken, Vid. Med. Nat. Foren. Copenh., 1862 (1863), p. 266; extr. p. 114 (S. Domingo). Boulenger, Cat. Liz. Brit. Mus., **2**, 1885, p. 44 (S. Domingo). Garman, Bull. Essex Inst., **19**, 1887, p. 48 (Samaná, S. Domingo). Fischer, Jahrb. Hamburg. Wiss. Anst., **5**, 1888, p. 30 (Cape Haytien, Hayti; H. Rolle coll.). Müller, Verh. Naturf. Ges. Basel, **10**, no. 1, 1892, p. 211 (Cape Haytien). Meerwarth, Mitth. Naturh. Mus. Hamburg, **11**, 1900 (1901), p. 25. Barbour, Mem. Mus. Comp. Zoöl., **44**, 1914, p. 295 (Haiti; concludes that this sp. = *coelestinus*, which is incorrect). Schmidt, Bull. Amer. Mus. Nat. Hist., **44**, 1921, p. 11, fig. 8 (distr., color in life, relation with *iodurus*, *evermanni*). Cochrane, Proc. U. S. Nat. Mus., **66**, art. 6, 1924, p. 4 (locality records).

Anolis bullaris Gray, Cat. Liz. Brit. Mus., 1845, p. 206 (Martinique; from museum, Paris). (Not of Linnaeus?).

Anolis laeviceps Lichtenstein, Nomencl. Rept. Amph. Mus. Berlin, 1856, p. 7 (type locality, unknown; type in Berlin Museum?).

Anolis chrysolepis Duméril and Bibron, Erp. Gén., **4**, 1837, p. 95 (type locality; French and Dutch Guiana (Guyane et Surinam), coll. of Leschenault and Doumerc and of Emmanuel Rousseau); (types two spec. in Paris Museum). Peters, Monatsb., Berl. Acad., 1863, p. 142 (nominal mention with a short synonymy). Bocourt, Miss. Sci.

Mex., Rept., livr. **2**, 1873, p. 99, livr. **4**, 1874, pl. 16, fig. 26 (redescribes the type and others from the Guianas and "Mexico"). Boulenger, Cat. Liz. Brit. Mus., **2**, 1885, p. 89 (some new locality records, among them Honduras and the Island of Grenada where the species does not occur). Mole and Urich, Jour. Trinidad Field Naturalists Club, **2**, 1894, p. 81 (first record for Trinidad). Beebe, Zoölogica N. Y., **2**, **7**, 1919, p. 211 (Bartica, distr. Brit. Guiana).

Draconura chrysolepis Gray, Cat. Liz. Brit. Mus., 1845, p. 207 (old specimen "West Indies," T. Bell coll., not mentioned in Blgr. Cat.).

Anolis planiceps Troschel, in Schomburgk, Reise in Brit. Guiana, **3**, 1848, p. 649 (confused with *A. nitens* Wagler) (according to Peters, who also credited the use of this name to Wiegmann as a synonym of *chrysolepis*). Apparently, however, *planiceps* never appeared but once in print and then Troschel had only *chrysolepis*.

Anolis nummifer O'Shaughnessy, Ann. Mag. Nat. Hist., (4), **15**, 1875, p. 278 (types 3 from Demarara Falls, in Brit. Mus.).

Anolis cynocephalus Bocourt, Nouv. Archiv. Mus. Paris, **6**, 1870, bull., p. 13 (type 1 ex. Paris Mus., from Cayenne, Lèprieur coll.).

Anolis turmalis O'Shaughnessy, Ann. Mag. Nat. Hist., (4), **15**, 1875, p. 278 (types 3 in Brit. Mus. from Grenada, B. W. I., 1 oc. incorrect).

In Trinidad not uncommon woodland species. Often seen in the plantations of cacao.

Anolis (Ctenocercus) coelestinus Cope, Proc. Acad. Nat. Sci. Phila., 1862, p. 177 (type locality, near Jeremie, western Hayti; type in Mus. Comp. Zoöl., 1500); Proc. Amer. Philos. Soc., **18**, Aug. 11, 1879, p. 272 (Port au Prince, Haiti; Gabb coll.). Garman, Bull. Essex Inst., **19**, 1887, p. 48 (Tiburon, Hayti).

Anolis chlorocyanus Barbour (part.), Mem. Mus. Comp. Zoöl., **44**, 1914, p. 295.

A. coelestinus seems to be very distinct from *A. chlorocyanus*, to which it is closely related. The chief distinction seems to be in the greater number of scale rows between occipital and supraorbital semicircle, viz. 4 to 5 against 3 in *A. chloro-cyanus* and greater number of loreal rows. This species also has smaller scales on the back, very fine scales on the dewlap, a different habit and coloration. *A. coelestinus* seems to be confined to the western end of the island,

A. chloro-cyanus to the eastern, but this may not be true, for Fischer had "*A. chloro-cyanus*" from Cape Haytien with 3 scales between occipital and supraorbital semicircle.

Anolis conspersus Garman, Proc. Amer. Philos. Soc., **24**, 1887, p. 273 (type locality, Grand Cayman, West Indies; types in Mus. Comp. Zoöl., 6,021, coll. Richardson; cotype, 39,292, U. S. Nat. Mus.). Barbour, Mem. Mus. Comp. Zoöl., **44**, 1914, p. 282 (crit.).

A. (nolis) grahamii Boulenger, Zoöl. Rec., 1887 Rept., p. 10 (refers *A. conspersus* to this sp.).

While on a visit to Grand Cayman in April, 1928, as a guest on Mr. Allison V. Armour's yacht "Utowana," I was unable to find this species. It must be said, however, that the island was suffering from one of the worst droughts in its history.

Anolis cristatellus Duméril and Bibron, Erp. Gén., **4**, 1837, p. 143 (type locality, Martinique, in error). Stejneger, Ann. Rep. U. S. Nat. Mus., 1902 (1904), p. 638, fig. 92–94 (syn., desc., distr. all Virgin Is., Porto Rico, Culebra, Vieques). Barbour, Mem. Mus. Comp. Zoöl., **44**, 1914, p. 274 (crit., syn.); Proc. Biol. Soc. Wash., **30**, 1917, p. 99 (distr.; St. Thomas, Anegada, Tortola, Virgin Gorda, Water Island, Mosquito Island). Fowler, Publ. Carnegie Inst. Wash., no. 252, 1918, p. 10, fig. 5 (variation, cephalic squamation). Schmidt, Ann. N. Y. Acad. Sci., **28**, 1920, p. 186 (full discussion of status, distrib., stomach contents).

Anolis scriptus Garman (part), Bull. Essex Inst., **19**, 1887, p. 28 (type locality "Silver and Lena Keys" Florida; *in errore;* types 972+3 from Silver Key and 4333 from Los Cayos de la Leña, Cuba=A. homolechis.

According to J. L. Peters and others who have visited these islands recently this form is abundant and widespread.

Anolis cuvieri Merrem, Syst. Amph., 1820, p. 45 (type locality, Jamaica, in error). Stejneger, Ann. Rep. U. S. Nat. Mus., 1902 (1904), p. 627, figs. 81–84 (syn., descr., distrib.; Porto Rico, Vieques, Tortola). Barbour, Mem. Mus. Comp. Zoöl., **44**, 1914, p. 273. Fowler, Publ. Carnegie Inst. Wash., no. 252, 1918, p. 7. Schmidt, Ann. N. Y. Acad. Sci., **28**, 1920, p. 185 (distrib. and notes stomach contents).

The only common member of this group of large Greater Antillean species is the Jamaican *Anolis garmani* Stejneger. This species like *A. equestris* Merrem of Cuba, and *A. ricordii* D. and B. of Haiti is distinctly rare.

Anolis (Dracontura) cyanopleurus Cope, Proc. Acad. Nat. Phila., 1861, p. 211 (type locality, Monte Verde, Cuba; types in Smithson. Inst., 5,737; coll. Wright). Bocourt, Miss. Scient. Mexique, Zoöl., Rept., livr. **3**, 1874, pl. 16, fig. 29 (Cuba).

Anolis cyanopleurus Gundlach, Contrib. Erp. Cubana, 1880, p. 48 (Cuba). Boulenger, Cat. Liz. Brit. Mus., **2**, 1885, p. 69 (Cuba; Brit. Mus.). Barbour, Mem. Mus. Comp. Zoöl., **44**, 1914, p. 292. Barbour and Ramsden, Mem. Soc. Pocy Havana, **2**, 1916, p. 136; Mem. Mus. Comp. Zoöl., **47**, 1919, p. 150, pl. 4, fig. 1, pl. 6, fig. 6, pl. 8, figs. 1–3 (rediscovery, notes, crit.).

One of the most lovely members of the genus. It was known from the type alone until Dr. Ramsden rediscovered it.

Anolis cybotes Cope, Proc. Acad. Nat. Sci. Phila., 1862, p. 177 (type locality, near Jeremie, Hayti; type in Mus. Comp. Zoöl., 3,619, coll. Weinland); Proc. Amer. Philos. Soc., **11**, 1869, p. 164; ibid., **18**, Aug. 11, 1879, p. 273 (Port-au-Prince, Haiti; Gabb coll.). Boulenger, Cat. Liz. Brit. Mus., **2**, 1885, p. 34, pl. 1, fig. 5 (San Domingo). Garman, Bull. Essex Inst., **19**, 1887, p. 42; extr. p. 18 (Jeremie, Hayti; Samaná, San Domingo). Fischer, Jahrb. Hamburg. Wiss. Anst., **5**, 1888, p. 24 (Cape Haytien; Sans Souci, Hayti). Meerwarth, Mitth. Naturh. Mus. Hamburg, **11**, 1900 (1901), p. 24 (crit., locs.). Müller, Verh. Naturh. Ges. Basel, **10**, no. 1, 1892, p. 211 (Cape Haitien). Barbour, Mem. Mus. Comp. Zoöl., **44**, 1914, p. 283 (Samanà, San Domingo; Jeremie and Diquini, Hayti). Schmidt, Bull. Amer. Mus. Nat. Hist., **44**, 1921, p. 12, fig. 10 (distr., rel. with *A. cristatellus*). Cochran, Proc. U. S. Nat. Mus., **66**, art. 6, 1924, p. 4 (loc. records).

Anolis riisei Reinhardt and Lütken, Vid. Med. Nat. Foren. Copenh., 1862 (1863), p. 264; extr. p. 112 (type locality, Hayti; Mus. Copenh., Riise coll.).

Anolis citrinellus Cope, Proc. Acad. Nat. Sci. Phila., 1864, p. 170 (type locality, Hayti; type in Brit. Mus. [is a young *A. cybotes*]. Boulenger, Cat. Liz. Brit. Mus., **2**, 1885, p. 35, pl. 1, figs. 3–3a

(type). Garman, Bull. Essex Inst., **19**, 1887, p. 42; extr. p. 18 (Port-au-Prince, Hayti; Mus. Comp. Zoöl., 1,326 (4 specimens; coll. Achermann). Barbour, Mem. Mus. Comp. Zoöl., **44**, 1914, p. 283 (Port-au-Prince, Haiti). Schmidt, Bull. Amer. Mus. Nat. Hist., **44**, 1921, p. 13.

Anolis haetianus Garman, Bull. Essex Inst., **19**, 1887, p. 42; extr. p. 18 (type locality, Tiburon, Hayti; types in Mus. Comp. Zoöl., 6,191 (3 ex.), coll. S. Garman). Barbour, Mem. Mus. Comp. Zoöl., **44**, 1914, p. 283 (crit.). Schmidt, Bull. Amer. Mus. Nat. Hist., **44**, 1921, p. 13.

The Haitian representative of the Cuban *A. sagrei*. It has similar habits and is similarly abundant.

Anolis distichoides Rosén, Lunds, Univ. Aresk., (2), **7**, art. 5, 1911, p. 29 (type locality, Mastic Creek and Stanniard Creek, Andros Island, Bahamas; types in Zoöl. Mus., Lund Univ., Lund, Sweden). Barbour, Mem. Mus. Comp. Zoöl., **44**, 1914, p. 283 (Andros Island).

The very common representative on Andros Island of the ordinary and widespread *A. distichus* Cope of the other Bahamas. Based on a slight difference in the color of the dewlap only, it is not a very well defined form.

Anolis distichus Cope, Proc. Acad. Nat. Sci. Phila., 1861, p. 208 (type locality, New Providence I., Bahamas; types in Phila. Acad. and Smithson. Inst.; coll. Wood); Proc. Amer. Philos. Soc., **11**, 1869, p. 164; Proc. U. S. Nat. Mus., **10**, 1887, p. 436 (New Providence; Abaco); Proc. Acad. Nat. Sci. Phila., 1894, p. 430 (New Providence I.; Moore coll.). Barbour (part.), Bull. Mus. Comp. Zoöl., **46**, No. 3, Dec., 1904, p. 58 (New Providence, Andros I., Bahamas). Rosén, Lunds, Univ. Arssk., N. F., (2), **7**, art. 5, 1911, p. 28 (desc., color in life, crit.). Barbour, Mem. Mus. Comp. Zoöl., **44**, 1914, p. 282 (Bahamas and Haiti).

A common and widespread species. This is the lizard so well known to tourists as the one which swarms over the trunk of the giant ceiba tree in the Court House Square at Nassau.

Anolis dominicensis Reinhardt and Lütken, Vid. Med. Nat. Foren. Copenh., 1862 (1863), p. 261; extr. p. 109 (type locality, Hayti; types in Mus. Copenhagen).

Anolis brevirostris Bocourt, Nouv. Arch. Mus. Paris, **6**, 1870, Bull., p. 11 (type locality, Hayti); Miss. Scient. Mexique, Zoöl., Rept., livr. **2**, 1873, pl. 14, fig. 6.

Anolis distichus Boulenger, Cat. Liz. Brit. Mus., **2**, 1885, p. 33 (San Domingo; Brit. Mus.) (not of Cope). Garman, Bull. Essex Inst., **19**, 1887, p. 42; extr. p. 18 (Hayti). Fischer, Jahrb. Hamburg. Wiss. Anst., **5**, 1888, p. 24 (Cape Haytien, Marmelade, Plaisance, Hayti; H. Rolle coll.). Müller, Verh. Naturf. Ges. Basel, **10**, no. 1, 1892, p. 211 (Aux Cayes, Hayti; Basel Mus.). Meerwarth, Mitth. Naturh. Mus. Hamburg, **11**, 1900 (1901), p. 23 (color, etc.; San Domingo and St. Thomas *in errore*). Schmidt, Bull. Amer. Mus. Nat. Hist., **44**, 1921, p. 12, fig. 9 (distr., color in life); ibid., **44**, 1921, p. 556 (Navassa). Cochran, Proc. U. S. Nat. Mus., **66**, art. 6, 1924, p. 4 (loc. records).

Anolis biauritus Meerwarth, Mitth. Naturh. Mus. Hamburg, **18**, 1900 (1901), p. 23 (type locality; Haiti; types in Hamburg Mus., 1486 A–C; coll. Tippenhauer).

This species is closely allied to *A. distichus* of the Bahamas. It is found on both Haiti and La Gonave Island. It is probably also related to *A. alliaceus* of Cuba.

Anolis doris Barbour, Proc. Biol. Soc. Wash., **38**, July 25, 1925, p. 101 (type locality, La Gonave Island, Haiti; type in Mus. Comp. Zoöl., 13,739, G. M. Allen coll.).

During a short visit to La Gonave in February, 1929, which occurred in the midst of a protracted drought, but one adult male of this species was caught. I find that it confirms the validity of the species.

Anolis equestris Merrem, Syst. Amph., 1820, p. 45 (type locality, unknown). Duméril and Bibron, Erp. Gén., **4**, 1837, p. 157 (Cuba; Mus. Paris; coll. Poey and de la Sagra). Gundlach, Contrib. Erp. Cubana, 1880, p. 37 (Cuba; habits, color in life). Boulenger, Cat. Liz. Brit. Mus., **2**, 1885, p. 21 (Cuba and Jamaica, given as habitat, but specimens listed from Cuba only). Barbour, Mem. Mus. Comp. Zoöl., **44**, 1914, p. 272 (Cuba, var. locs.). Barbour and Ramsden, Mem. Soc. Poey Havana, **2**, 1916, p. 133 (Cuba, var. locs.). Stejneger, Proc. U. S. Nat. Mus., **53**, 1917, p. 268, figs. 42–45 (notes). Barbour and Ramsden, Mem. Mus. Comp. Zoöl., **47**, 1919, p. 133, pl. 14, fig. 5 (Cuba; desc., crit., locs.).

The finest and largest Antillean Anole. It occurs sparingly throughout Cuba. Found in orchards of mangos and other dense fruit trees it is not improbably more common than it seems to be. During the dry season it is excessively rare and very difficult to find.

Anolis evermanni Stejneger, Ann. Rep. U. S. Nat. Mus., 1902 (1904), p. 647, figs. 102–104 (type locality, Catalina Plantation, alt. 890 feet, Porto Rico). Barbour, Mem. Mus. Comp. Zoöl., **44**, 1914, p. 284. Schmidt, Ann. N. Y. Acad. Sci., **28**, 1920, p. 188 (distr., discussion of relationship with *A. mayeri* Fowler).

We have no information to add concerning this species beyond that given by Stejneger and Schmidt. It is perhaps a representative form allied to *Anolis mayeri* Fowler which, however, is the same as *A. leucophaeus* Garman.

Anolis forresti Barbour, Occ. Papers Mus. Zoöl. Univ. Mich., no. 132, Feb. 10, 1923, p. 4 (type locality, Barbuda, B. W. I., type Mus. Comp. Zoöl., 16,170; coll. W. R. Forrest of Antigua).

This island is but rarely visited by naturalists and so far as I am aware only the types have ever been taken.

Anolis garmani Stejneger, Amer. Naturalist, **33**, July, 1899, p. 602 (Jamaica). Barbour, Bull. Mus. Comp. Zoöl., **52**, 1910, p. 294; Mem. Mus. Comp. Zoöl., **44**, 1914, p. 273; Handbook of Jamaica, 1922, sep. p. 3 (note).

Anolis edwardsii Griffith, Animal Kingdom, **9**, 1830, p. 228, pl. (not of Merrem, 1820). Duméril and Bibron, Erp. Gén., **4**, 1837, p. 161 (Cayenne?). Boulenger, Cat. Liz. Brit. Mus., **2**, 1885, p. 24 (Jamaica).

Dactyloa edwardsii Gray, Ann. Mag. Nat. Hist., (1), **4**, April, 1840, p. 111; Cat. Liz. Brit. Mus., 1845, p. 198 (Jamaica). Gosse, Nat. Sojourn in Jamaica, 1851, p. 142, pl. 4 (Bluefield Ridge; St. Elizabeth's Hills; Mt. Edgecombe).

The lovely Venus Lizard of Gosse, a name, of course, of his own coining. A common species of the moister wooded portions of the whole island of Jamaica. Not observed in the higher mountains.

Anolis gentilis Garman, Bull. Essex Inst., **19**, 1888, p. 34 (type locality Petit Martinique, The Grenadines, B. W. I., types in Mus. Comp. Zoöl., 6,163, Garman coll.).

Anolis cinereus Garman, Bull. Essex Inst., **19**, 1888, p. 35 (type locality St. George, Grenada, B. W. I., types in Mus. Comp. Zoöl., 6,187, Garman coll.).

The name *gentilis* has page priority over *cinereus*. I cannot and would not expect to be able to separate these two forms. The species has a broader snout than *A. vincenti* but has also a similar pavement-like squamation and the mottled gray-green style of coloration, not the monochrome green.

Anolis gingivinus Cope, Proc. Acad. Nat. Sci. Phila., 1864, p. 170 (type locality, "Anguilla Rock, near Trinidad"; types in Brit. Mus.); Proc. Amer. Philos. Soc., **11**, 1869, p. 159 (St. Martins); Proc. Acad. Nat. Sci. Phila., 1871, p. 220 (St. Eustatius). Boulenger, Cat. Liz. Brit. Mus., **2**, 1885, p. 28, pl. **2**, fig. 1 (Anguilla Island). Garman, Bull. Essex Inst., **19**, 1887, p. 29, extr. p. 5 (Anguilla I.; Mus. Comp. Zoöl., Dr. W. J. Branch coll.). Barbour, Mem. Mus. Comp. Zoöl., **44**, 1914, p. 275; Occ. Papers Mus. Zoöl. Univ. Mich., no. 132, Feb. 10, 1923, p. 4 (crit., distr.).

Anolis virgatus Garman, Bull. Essex Inst., **19**, 1887, p. 41; extr. p. 17 (type locality, St. Barts, W. I.; types, in Mus. Comp. Zoöl., 6,165; coll. Lagois; cotype No. 39,300, U. S. Nat. Mus.)

Mr. J. L. Peters has found this species common wherever it occurs and secured large series during his several journeys to the Northern Lesser Antilles.

Anolis gorgonae Barbour, Bull. Mus. Comp. Zoöl., **46**, 1905, p. 99 (type locality, Gorgona Island, Colombia; types Mus. Comp. Zoöl., 6,984; 2 cotypes; also 1 in Mus. Univ. Mich., W. W. Brown coll.).

This little green (blue in alc.) Anolis seems to be really most nearly allied to *S. purpurascens* Cope from the Truando R. region of Colombia.

Anolis grahami Gray, Cat. Liz. Brit. Mus., 1845, p. 274 (renaming his *A. punctatus* (cf. below) (preoc.), p. 203 (types in Brit. Mus. from "Brazils" and "?"). Boulenger, Cat. Liz. Brit. Mus., **2**, 1885, p. 32 (part; badly confused with other Jamaican species).

Anolis punctatus Gray, Ann. Mag. Nat. Hist., (1), **5**, 1840, p. 112 (type locality, unknown; types in Brit. Mus.); Cat. Liz. Brit. Mus., 1845, p. 203 (not of Daudin).

Anolis grahami Cope, Proc. Amer. Philos. Soc., **11**, 1869, p. 164 (states in error that Gray's *grahami* is juv. of *iodurus*).

Anolis punctatissimus Hallowell, Proc. Acad. Nat. Sci. Phila., 1856, p. 225 (type lost, should be in Phila. Acad.; coll. Dr. Betton).

Anolis grahamii Garman, Bull. Essex Inst., **19**, 1887, p. 39; extr. p. 15 (Kingston, Jamaica). Boulenger, Cat. Liz. Brit. Mus., **2**, 1885, p. 32 (Jamaica) (part only, badly confused with other species). Cope, Proc. Acad. Nat. Sci. Phila., 1894, p. 438 (Port Morant, Port Lucea, Port Antonio, Jamaica; Moore coll.). Meerwarth, Mitth. Naturh. Mus. Hamburg, **11**, 1900 (1901), p. 23. Barbour, Bull. Mus. Comp. Zoöl., **52**, 1910, p. 296 (species reëstablished as distinct from *A. opalinus* and *A. iodurus*); Mem. Mus. Comp. Zoöl., **44**, 1914, p. 281 (note); Handbook of Jamaica, 1922, sep. p. 3 (note).

Not an uncommon species, principally but probably not wholly to be found in the moist eastern portion of the island.

There is every likelihood that this is the *Lacerta bullaris* Linné, Syst. Nat., ed. 10, **11**, 1758, p. 208 (type locality Jamaica; based on Catesby's (Carolina, **2**, 1743, p. 66) Lacerta viridis jamaicensis. It is best to disregard this name as unrecognizable.

Anolis greyi Barbour, Mem. Mus. Comp. Zoöl., **44**, 1914, p. 287 (type locality, Camaguey City, Cuba; T. Barbour coll.; type in Mus. Comp. Zoöl., 7,890). Barbour and Ramsden, Mem. Soc. Poey Havana, **2**, 1916, p. 134; Mem. Mus. Comp. Zoöl., **47**, 1919, p. 144, pl. 7, fig. 3.

Found by Dr. Carlos de la Torre in the Sierra de Cubitas, Prov. Camaguey, Cuba and by Barbour in and about Camaguey City. Not known elsewhere.

Anolis griseus Garman, Bull. Essex Inst., **19**, 1887, p. 36; extr. p. 12 (type locality, St. Vincent; types in Mus. Comp. Zoöl., 6,184; coll. Garman). Barbour, Mem. Mus. Comp., **44**, 1914, p. 277 (crit.).

Anolis richardii Boulenger, Proc. Zoöl. Soc. London, 1891, p. 355 (St. Vincent; Brit. Mus.; coll. Smith) (not of Duméril and Bibron).

I saw no specimens of this lizard either in the Botanical Garden or on a long tour of the Island to Georgetown on N. E. coast (March, 1929).

Anolis gundlachi Peters, Monatsber. Berlin Akad., 1876, p. 705 (type locality, Utuado, Porto Rico; types in Berlin Mus., Gundlach coll.). Stejneger, Ann. Rep. U. S. Nat. Mus., 1902 (1904), p. 633, figs. 89–91 (syn., desc.; Porto Rico). Barbour, Mem. Mus. Comp. Zoöl., **44**, 1914, p. 273. Fowler, Publ. Carnegie Inst. Wash., no. 252, 1918, p. 9. Schmidt, Ann. N. Y. Acad. Sci., **28**, 1920, p. 188 (distr.).

We have nothing to add to the information cited above. The species was found to be abundant by G. M. Allen and J. L. Peters on their visit to Porto Rico in 1917.

Anolis hendersoni Cochran, Journ. Wash. Acad. Sci., **13**, June 4, 1923, p. 225 (type locality, Petionville, Haiti; type in U. S. Nat. Mus., 59,210; J. B. Henderson and P. Bartsch coll.).

Xiphosurus cristatellus Gray, Cat. Liz. Brit. Mus., 1845, p. 197 (not of Duméril and Bibron) ("West Indies?"; Brit. Mus.).

Xiphosurus homolechis Cope, Proc. Acad. Nat. Sci. Phila., 1864, p. 169 (type locality, "West Indies"—the island unknown; type in Brit. Mus.).

Not uncommon. Taken by Dr. Allen in 1919, but not recognized as different from *A. semilineatus*, which it surely is.

Anolis homolechis Boulenger, Cat. Liz. Brit. Mus., **2**, 1885, p. 28, pl. 1, fig. 4 (West Indies). Müller, Verh. Naturf. Ges. Basel, **10**, no. 2, 1892, p. 211 (Cuba). Meerwarth, Mitth. Naturh. Mus. Hamburg, **11**, 1900 (1901), p. 22 (crit.). Barbour, Mem. Mus. Comp. Zoöl., **44**, 1914, p. 274 (Cuba). Barbour and Ramsden, Mem. Soc. Poey Havana, **2**, 1916, p. 136 (Cuba). Stejneger, Proc. U. S. Nat. Mus., **53**, 1917, p. 269, figs. 46–48. Barbour and Ramsden, Mem. Mus. Comp. Zoöl., **47**, 1919, p. 155, pl. 14, fig. 8 (Cuba; desc., crit., distr.).

Anolis scriptus (part) Garman, Bull. Essex Inst., **19**, 1887, p. 23 (type locality, "Silver and Lena Keys, Florida" *in errore*); types part *A. cristatellus* and one Mus. Comp. Zoöl., 4,333 = *A. homolechis*. Lena Key = Cayos de la Leña; Cuba.

Anolis muelleri Ahl, Arch. f. Naturg., **90**, 1924, p. 247 (Cuba; Gundlach Coll.; type a ♀ in Berlin Mus.).

A common and widely distributed species of scrubby woods and especially of wooded ravines with streams. It is generally resting head downward on some stick or trunk, almost black, the males flashing an ivory white dewlap. This and several Cuban species keep the end of the tail curled up while resting, and when disturbed switch and wiggle the distal third nervously. It almost seems that the tail is in process of becoming prehensile. Break up a termite nest and scatter the inmates about and stand by a bit, and individuals of this species and of *A. sagrei*, D. and B. will appear as if by magic to devour the insects.

Anolis iodurus Gosse, Ann. Mag. Nat. Hist., (2), **6**, Nov., 1850, p. 344 (type locality, Jamaica; types in Brit. Mus.; coll. Gosse); Nat. Sojourn in Jamaica, 1851, p. 217. Cope, Proc. Acad. Nat. Sci. Phila., 1861, p. 210. Bocourt, Miss. Scient. Mexique, Zoöl., Rept., livr. **2**, 1873, pl. 14, fig. 17 (Jamaica). Barbour, Bull. Mus. Comp Zoöl., **52**, 1910, p. 295; Mem. Mus. Comp. Zoöl., **44**, 1914, p. 282 (crit.); Handbook of Jamaica, 1922, sep. p. 3 (color in life).

Anolis punctatissimus Hallowell, Proc. Acad. Nat. Sci. Phila., 1856, p. 225 (type formerly in Mus. Phila. Acad., now apparently lost).

There is nothing especially new to be added concerning this species except perhaps to point out that this and the two other species so often confused may be distinguished as follows: *A. grahami* Cope; ventral scales keeled: *A. iodurus* Gosse; ventrals smooth, head elongate: *A. opalinus* Gosse; ventrals smooth and head rather short and broad.

Anolis (Ctenocercus) isolepis Cope, Proc. Acad. Nat. Sci. Phila., 1861, p. 214 (type locality, Monte Verde, Cuba; types in Smithson. Inst., No. 5,738; coll. Wright). Gundlach, Contrib. Erp. Cubana, 1880, p. 47. Boulenger, Cat. Liz. Brit. Mus., **2**, 1885, p. 46 (Cuba; Brit. Mus.). Barbour, Mem. Mus. Comp. Zoöl., **44**, 1914, p. 284 (Cuba). Barbour and Ramsden, Mem. Soc. Poey Havana, **2**, 1916, p. 134; Mem. Mus. Comp. Zoöl., **47**, 1919, p. 137, pl. 7, fig. 2 (crit., distr.; Cuba).

A very rare species of the moist mountains of eastern Cuba. It may be the eastern representative of *A. angusticeps* Hallowell, but it is very different and is confined to a very different sort of habitat.

Anolis krugi Peters, Monatsber. Berlin Acad., 1876, p. 707 (type locality, Porto Rico; types Mus. Berlin, 8,965). Stejneger, Ann. Rep. U. S. Nat. Mus., 1902 (1904), p. 655, figs. 108–111 (syn., desc., distr.; Porto Rico). Barbour, Mem. Mus. Comp. Zoöl., **44**, 1914, p. 284. Fowler, Publ. Carnegie Inst. Wash., no. 252, 1918, p. 11 (Guanica, Porto Rico). Schmidt, Ann. N. Y. Acad. Sci., **28**, 1920, p. 190 (details of distr., variations).

I have nothing to add concerning this species beyond what has been recorded, and to say that it has appeared in all the recent collections. It seems to be allied to *A. acutus* and *A. wattsi*.

Anolis latirostris Schmidt, Bull. Amer. Mus. Nat. Hist., **41**, 1919, p. 521 (type locality, Navassa Island; type in Amer. Mus. Nat. Hist., 12,598, coll. by R. H. Beck in 1917); ibid., **44**, 1921, p. 456, fig. 2.

Known from the type only.

Anolis leachii Duméril and Bibron, Erp. Gén., **4**, 1837, p. 153 (type locality, "Antilles"; type in Paris Mus.). Bocourt, Miss. Scient. Mexique, Zoöl., Rept., livr. **2**, 1873, pl. 14, fig. 13 (type). Boulenger, Cat. Liz. Brit. Mus., **2**, 1885, p. 29 (part; Guadeloupe). Günther, Ann. Mag. Nat. Hist., (6), **2**, Nov., 1888, p. 363 (Guadeloupe). Boulenger, Ann. Mag. Nat. Hist., (6), **14**, 1894, p. 375 (Antigua= *antiquae* Barb., q. v.). Barbour, Mem. Mus. Comp. Zoöl., **44**, 1914, p. 277 (crit.).

Xiphosurus ferreus Cope, Proc. Acad. Nat. Sci. Phila., 1864, p. 168 (type locality, "Guadeloupe"; type in Brit. Mus.).

This species which Dr. Noble found so abundant in 1914 is at the moment rare. It is not to be found about Point à Pitre since the hurricane and tidal wave of Sept. 12, 1928. A long walk in Feb., 1929 did not reveal a single specimen. The mongoose has become extremely abundant on this island.

Anolis leucophaeus Garman, Bull. Essex Inst., **20**, 1888, p. 109, sep. p. 9; (type locality, Inagua, Bahamas; type in Mus. Comp. Zoöl., 6,226, a young specimen) (C. J. Maynard coll.). Barbour, Mem. Mus. Comp. Zoöl., **44**, 1914, p. 295. Stejneger, The Bahama Is., 1905, p. 334 (crit.).

Anolis moorei Cope, Proc. Acad. Nat. Sci. Phila., 1894, p. 433, pl. 11, fig. 4 (type locality, Great Inagua, Bahamas; type in Acad. Nat. Sci. Phila., Moore collection (an adult male).

Anolis cinnamomeus Cope, Proc. Acad. Nat. Sci. Phila., 1894, p. 435, pl. 12, fig. 6 (type locality, Great Inagua, Bahamas; type in Acad. Nat. Sci. Phila., coll. Moore; (an immature example).

Anolis albipalpebralis Barbour, Proc. Biol. Soc., Wash., **29**, 1916, p. 215 (Grand Turk, Turk's Islands, Bahamas, L. C. Mowbray coll.; type in Mus. Comp. Zoöl., 11,954).

Anolis mayeri Fowler, Publ. Carnegie Inst. Wash., no. 252, 1918, p. 8, fig. 4 (type locality, "Virgin Islands"; type in Mus. Princeton Univ., 3,151; paratypes in Mus. Comp. Zoöl. and Amer. Mus. Nat. Hist.).

Sent to Cambridge in series by the Hon. G. Whitfield Smith, former Commissioner in Grand Turk, and by Mr. Louis A. Mowbray. It is apparently a very common form.

Anolis lineatopus Gray, Ann. Mag. Nat. Hist., (1), **5**, April, 1840, p. 113 (type locality, unknown; type in Brit. Mus.). Boulenger, Cat. Liz. Brit. Mus., **2**, 1885, p. 39, pl. 1, figs. 1–2 (Jamaica). Garman, Bull. Essex Inst., **19**, 1887, p. 47; extr. p. 23 (Kingston. Jamaica; Mus. Comp. Zoöl., Garman coll.). Meerwarth, Mitth. Naturh. Mus. Hamburg, **11**, 1900 (1901), p. 25. Barbour, Bull. Mus. Comp. Zoöl., **52**, 1910, p. 294 (notes on distr., abundance); Mem. Mus. Comp. Zoöl., **44**, 1914, p. 286.

Anolis maculatus Gray, Ann. Mag. Nat. Hist., (1), **5**, April, 1840, p. 113 (type locality, unknown; types in Brit. Mus.) (not of Gray, op. cit., p. 112). Cope, Proc. Acad. Nat. Sci. Phila., 1861, p. 209 (Jamaica; Smithson. Inst.; Adams coll.). Reinhardt and Lütken, Vid. Med. Nat. Foren., Copenh., 1862 (1863), p. 268; extr. p. 116 (Jamaica). Bocourt, Miss. Scient. Mexique, Zoöl., Rept., livr. **2**, 1873, pl. 14, fig. 18 (Jamaica).

Anolis heterolepis Hallowell, Proc. Acad. Nat. Sci. Phila., 1856, p. 230 (Cienfuegos, Cuba; coll. Capt. Baker, 9,515, Mus. Phila., *in errore*, probably Kingston, Jamaica; coll. Capt. Baker). Type examined by T. B.

Anolis lineatotus (err. typ.) Barbour, Handbook of Jamaica, 1922, sep. p. 3 (distr. in Jamaica).

As I have previously observed (Handbook of Jamaica, 1922), this very distinct species is confined to the dry dusty Liguanea Plain about Kingston. It is always to be seen but becomes much more abundant after April first. Not being terrestrial it has suffered less from the mongoose than many other Jamaican species.

Anolis lineatus Daudin, Hist. Nat. Rept., **4**, 1802, p. 66, pl. 48, fig. 1 (type locality, "South America"; type in Paris Mus.?). Duméril and Bibron, Erp. Gén., **4**, 1837, p. 146 (Martinique, "if the locality is correct"; synonymy). (Cope, Proc. Amer. Phil. Soc., March 7, 1885, p. 181 (Aruba). Boulenger, Cat. Liz. Brit. Mus., **2**, 1885, p. 38 (Curaçao and synonymy to date). Meerwarth, Mit. Naturh. Mus. Hamburg, **11**, 1900 (1901), p. 25 (Martinique, *in errore*). Meek, Publ. Field Mus. Nat. Hist., Zoöl. Ser., **7**, no. 12, 1910, p. 416. (Aruba and Curaçao). Ruthven, Occ. Papers, Mus. Zoöl., Univ. Mich., no. 143, 1923, p. 7 (many loc. records for Curaçao and Aruba).

Anolis godetii Roux, Zoöl. Anz., **31**, 1907, p. 764 (type locality: "Antilles," type in Neuchatel Mus.).

Not an uncommon species about gardens where there is a little water. Otherwise it only abounds on this semi-desert island during the short period of rains.

Anolis lividus Garman, Bull. Essex Inst., **19**, 1887, p. 43; extr. p. 19 (type locality, Montserrat, W. I.; types in Mus. Comp. Zoöl., 6,176–7 (50 ex.); coll. Garman; cotypes, 39,303–4, U. S. Nat. Mus.). Barbour, Mem. Mus. Comp. Zoöl., **44**, 1914, p. 276.

I did not visit Montserrat on my 1929 voyage. I know that the island was completely devasted by the great hurricane of Sept., 1928, perhaps more so than any island except Marie Galante. Nevis, however, was also almost as completely ruined. Since the Anoles on these islands survived the destruction and remained really abundant, it is fair to expect that the same thing happened on Montserrat.

Anolis longiceps Schmidt, Bull. Amer. Mus. Nat. Hist., **41**, 1919, p. 521 (type locality, Navassa Island; type in Amer. Mus. Nat. Hist., 12,597, coll. by R. H. Beck in 1917); ibid., **44**, 1921, p. 556, fig. 1 (relationship).

The lighthouse keepers on Navassa who have made me several small collections usually send in little but this species. It must be by far the most common form on the isle.

Anolis longitibialis Noble, Amer. Mus. Novit., no. 64, Mar. 29, 1923, p. 5 (type locality, Beata Island, Dominican Republic; type in Amer. Mus. Nat. Hist., 24,329).

We have seen this well defined species in the shape of a paratype received by the Museum of Comparative Zoölogy in exchange from its describer. It is of interest to note, however, that on a two-day visit to Beata Island (Feb. 14–15, 1929) it was impossible to find the species although there had been recent rain and lizards of other genera were abundant. Evidently we have here again an example of the fortuitous nature of reptile collecting in the tropics.

Anolis (Acantholis) loysiana Cocteau, L'Institut, sect. 1, **4**, Aug. 31, 1836, p. 287 (type locality, Cuba; types in Paris Mus.; coll. de la Sagra); in de la Sagra's Hist. Fis. Pol. Nat. Cuba, **4**, 1838, p. 88; French ed., p. 141, pl. 14 (Cuba).

Anolis loysiana Duméril and Bibron, Erp. Gén., **4**, 1837, p. 100 (Cuba). Bocourt, Miss. Scient. Mexique, Zoöl., Rept., livr. **2**, 1873, p. 14, fig. 9 (Cuba). Gundlach, Contrib. Erp. Cubana, 1880, p. 51 (Cuba). Boulenger, Cat. Liz. Brit. Mus., **2**, 1885, p. 42 (Cuba; part). Barbour, Mem. Mus. Comp. Zoöl., **44**, 1914, p. 290 (Cuba). Barbour and Ramsden, Mem. Soc. Poey Havana, **2**, 1916, p. 135 (Cuba). Stejneger, Proc. U. S. Nat. Mus., **53**, 1917, p. 271 (nomenclature and distr.). Barbour and Ramsden, Mem. Mus. Comp. Zoöl., **47**, 1919, p. 146, pl. 3, fig. 4, pl. 7, fig. 4 (Cuba; desc., crit., distr.).

In many respects this is the most bizarre and peculiar member of the whole genus. When resting on the rough and light colored bark of a tree it is almost impossible to see and for this reason it may be more common than it appears to be.

Anolis luciae Garman, Bull. Essex Inst., **19**, 1887, p. 44; extr. p. 20 (type locality, St. Lucia, W. I.; types 6,173 in Mus. Comp. Zoöl.; coll. Garman; cotypes, 39,296–7, U. S. Nat. Mus.). Barbour, Mem. Mus. Comp. Zoöl., **44**, 1914, p. 298 (crit.).

Anolis alligator Cope, Proc. U. S. Nat. Mus., **12**, 1889, p. 141 (Santa Lucia; U. S. Nat. Mus., 15,085–105) (not of Duméril and Bibron). Boulenger, Proc. Zoöl. Soc. London, 1891, p. 353 (St. Lucia; Brit. Mus.; coll. Ramage).

Green or bronze uniform or mottled one color with the other, a short white stripe behind the fore limb. In the adult male the dewlap is very large and deep, pale ashy gray anteriorly, very pale yellow posteriorly, the scales being white. This is very distinct from the small solid yellow dewlap of *A. vincentii*.

Anolis lucius Duméril and Bibron, Erp. Gén., **4**, 1837, p. 105 (type locality, Cuba; type in Mus. Paris; coll. de la Sagra). Bocourt, Miss. Scient. Mexique, Zoöl., Rept., livr. **3**, 1874, pl. 14, fig. 5. Gundlach, Contrib. Erp. Cubana, 1880, p. 44; Barbour, Mem. Mus. Comp. Zoöl., **44**, 1914, p. 284 (crit., distr. in Cuba var. loc.). Barbour and Ramsden, Mem. Soc. Poey Havana, **2**, 1916, p. 134. Stejneger, Proc. U. S. Nat. Mus., **53**, 1917, p. 270 (note). Barbour and Ramsden, Mem. Mus. Comp. Zoöl., **47**, 1919, p. 138, pl. 6, fig. 4 (desc., crit., distr.).

On the limestone "paredones" of the valleys of San Carlos de Luis Lazo and Viñales, about the Abra del Yumuri near Matanzas and on the outcrops about the Arimao Valley in Santa Clara Province this lizard swarms. It may be found at all seasons of the year. About Matanzas it is called "Coronel" on account of the chevron-like markings on head and body. Though why chevrons should recall a colonel does not at once appear, but they connote a military title surely. Dr. Dunn found its eggs stuck fast to the rocks after the manner of many species of gecko.

Anolis lutcosignifer Garman, Bull. Essex Inst., **20**, 1888, pp. 4, 8 (type locality, Cayman Brac., W. I.; type in Mus. Comp. Zoöl., 6,228; C. J. Maynard coll.; also Little Cayman). Barbour, Mem. Mus. Comp. Zoöl., **44**, 1914, p. 290 (crit.).

"? (A.) sagrae" Boulenger, Zoöl. Rec., 1888, rept., p. 9.

I have never visited Cayman Brac and know nothing of the status of this species.

Anolis marmoratus Duméril and Bibron, Erp. Gén., **4**, 1837, p. 139 (type locality, Martinique; types in Paris Mus.; coll. Plée). Duméril, Cat. Méth. Rept. Mus. Paris, **1**, 1851, p. 58 (types). Reinhardt and Lütken, Vid. Med. Nat. Foren. Copenh., 1862 (1863), p. 258; extr. p. 106 (St. Thomas? or St. John?, W. I.; Mus. Copenh.; coll. Hornbeck). Boulenger, Cat. Liz. Brit. Mus., **2**, 1885, p. 31. Garman, Bull. Essex Inst., **19**, 1887, p. 32, extr. p. 8 (Desirade; Mus. Comp. Zoöl.; coll. Richardson). Barbour, Mem. Mus. Comp. Zoöl., **44**, 1914, p. 279 (crit.); Proc. Biol. Soc. Wash., **28**, 1915, p. 76 (crit.; concludes sp. not from Martinique but confined to Desirade).

Ptychnotus dumerilii Fitzsinger, Syst. Rept., 1843, p. 65 (part).

I have little to add to my notes of 1915 in which I gave the evidence for concluding that Plée really took this species on Desirade, not Martinique.

Anolis maynardii Garman, Bull. Essex Inst., **20**, 1888, p. 7 (type locality, Little Cayman, W. I.; type in Mus. Comp. Zoöl., 6,227; C. J. Maynard coll.). Barbour, Mem. Mus. Comp. Zoöl., **44**, 1914, p. 294.

It is worth noting that the Anoles of the several Cayman Islands bear no relation whatsoever to each other. This is the best defined species of the lot. They show no common origin and are probably of fortuitous origin — by flotation. It must be remembered, however, that each may be a relict of a larger number which once existed on each island.

Anolis mestrei Barbour and Ramsden, Proc. Biol. Soc. Wash., **29**, 1916, p. 19 (Valley of Luis Lazo, W. Cuba; T. Barbour coll.; type in Mus. Comp. Zoöl., 11,285). Stejneger, Proc. U. S. Nat. Mus., **53**, 1917, p. 272 (loc. records). Barbour and Ramsden, Mem. Mus. Comp. Zoöl., **47**, 1919, p. 161, pl. 10, fig. 3.

Anolis cubanus Ahl, Zoöl. Anz., **62**, 1925, p. 87 (type locality, Cuba; Gundlach coll.; type a ♂, in Berlin Mus.).

Not an uncommon species in the woods on the limestone hills of western Cuba.

Anolis monensis Stejneger, Ann. Rep. U. S. Nat. Mus., 1902 (1904), p. 646, figs. 98–101 (type locality, Mona Island). Barbour, Mem. Mus. Comp. Zoöl., **44**, 1914, p. 273.

There is no recent information concerning the status of this species.

Anolis nelsoni Barbour, Mem. Mus. Comp. Zoöl., **44**, 1914, p. 287 (Swan Island, Caribbean Sea; George Nelson coll.; type in Mus. Comp. Zoöl., 7,892).

This form was observed very abundantly when I visited Swan Island with Mr. Allison V. Armour on the yacht "Utowana" in April, 1928.

Anolis newtoni Günther, Ann. Mag. Nat. Hist., (3), **4**, 1859, p. 212, pl. 4, fig. A (type locality, St. Croix, W. I.; types in Brit. Mus., coll. A. and E. Newton).

I have no information concerning this species.

Anolis nubilus Garman, Bull. Essex Inst., **19**, 1887, p. 32; extr. p. 8 (type locality, Redonda I., W. I.; type in Mus. Comp. Zoöl., 6,180, coll. Richardson). Barbour, Mem. Mus. Comp. Zoöl., **44**, 1914, p. 277.

I was unable to land upon Redonda owing to heavy weather last winter. Since the great hurricane of Sept. 1928, the island is completely abandoned and uninhabited.

Anolis oligaspis Cope, Proc. Acad. Nat. Sci. Phila., 1894, p. 430, pl. 11, fig. 5 (type locality, New Providence, Bahamas; type formerly in Univ. of Penna., coll. Moore; now in Acad. Nat. Sci. Phila.). Rosén, Lunds Univ. Arssk., N. F., (2), **7**, art. 5, 1911, p. 30 (species listed only). Barbour, Mem. Mus. Comp. Zoöl., **44**, 1914, p. 294 (crit.).

A rare and uncommon species related to *Anolis angusticeps* Hallowell of Cuba.

Anolis olssoni Schmidt, Bull. Amer. Mus. Nat. Hist., **41**, 1919, p. 522 (type locality, El Morro (Moro) (sic) de Monte Cristi, San Domingo; type in Amer. Mus. Nat. Hist., 13,400; coll. by Axel Olsson); ibid., **44**, 1921, p. 11, figs. 6–7 (relationship, distr., habits). Cochran, Proc. U. S. Nat. Mus., **66**, art. 6, 1924, p. 4 (crit., orig. series of species types probably composite).

A not uncommon member of the group of slender grass-inhabiting species. One of the group of which Norops is the most advanced type. There are many specimens in the Museum of Comparative Zoölogy which were long confounded with *Anolis semilineatus*.

Anolis opalinus Gosse, Ann. Mag. Nat. Hist., (2), **6**, Nov., 1850, p. 345 (type locality, Jamaica; type in Brit. Mus., coll. Gosse); Nat. Sojourn in Jamaica, 1851, p. 217. Barbour, Bull. Mus. Comp. Zoöl., **52**, 1910, p. 296; Mem. Mus. Comp. Zoöl., **44**, 1914, p. 282; Handbook of Jamaica, 1922, sep. p. 3 (color in life).

Anolis flabellatus Cope, Proc. Acad. Nat. Sci. Phila., 1894, p. 439, pl. 12, fig. 7 (type localities, Port Morant and Port Lucea, Jamaica; types in Acad. Nat. Sci. Phila., formerly in coll. Moore, Univ. of Penna.).

What we have said under *Anolis iodurus* Gosse applies also to this species but this seems to be rather the least common of the three.

Anolis ordinatus Cope, Proc. Acad. Nat. Sci. Phila., 1864, p. 175 (type locality, "West Indies"; types in Brit. Mus.); Proc. U. S. Nat. Mus., **10**, 1887, p. 436 (Turk's Island, Bahamas; coll. Ebell in U. S. Nat. Mus.). Garman, Bull. Essex Inst., **19**, 1887, p. 47; extr. p. 23 (Bahamas; New Providence; Florida Keys). Cope, Proc. Acad. Nat. Sci. Phila., 1894, p. 432 (Eleuthera), p. 439 (New Providence); Stejneger, The Bahama Islands, 1905, p. 333 (Bahamas; crit.).

Anolis sagrae Barbour, Bull. Mus. Comp. Zoöl., **52**, 1910, p. 295 (Jamaica). Rosén, Lunds Univ. Arsskr., N. F. (2), **7**, art. 5, 1911, p. 33 (crit., has examined type of *ordinatus* in Brit. Mus. and concludes *sagrei* juv. and *ordinatus* ad. of same sp.). Barbour, Mem. Mus. Comp. Zoöl., **44**, 1914, p. 286 (crit., distr.).

I believe that since the Bahaman specimens differ constantly in having a brownish dewlap with black spots, while *A. sagrei* has an orange or reddish dewlap with black spots, that the two species should be kept apart. The Bahaman examples have larger dewlaps in the old males, a more pronounced nuchal crest in life and frequently assume a blackish, or blackish speckled with yellowish dots, type of coloration which I cannot recall seeing in Cuba.

Anolis patricius Barbour, Proc. N. Eng. Zoöl. Soc., **11**, Aug. 9, 1929, p. 37 (type locality, Mina Piloto, Sagua de Tanamo, Oriente Prov., Cuba; type in Mus. Comp. Zoöl., 28,759).

Dr. Ramsden secured a considerable series of this species at the type locality some years ago. It is the Eastern representative of *Anolis quadriocellifer* of Pinar del Rio Province.

Anolis poncensis Stejneger, Ann. Rep. U. S. Nat. Mus., 1902 (1904). p. 665, figs. 117–120 (type locality, hill three miles east of Ponce, Porto Rico). Barbour, Mem. Mus. Comp. Zoöl., **44**, 1914, p. 284, Fowler, Publ. Carnegie Inst. Wash., 252, 1918, p. 12 (Guanica, Porto Rico).

Anolis pencensis (sic) Schmidt, Ann. N. Y. Acad. Sci., **28**, 1920, p. 191 (distr., variations, status).

A restricted species in its distribution and one almost Noropslike in its adaptation to terrestrial life.

Anolis porcatus Gray, Ann. Mag. Nat. Hist., (1), **5**, April, 1840, p. 112 (type locality, Cuba). Garman, Bull. Essex Inst., **19**, 1887, p. 47;

extr. p. 23 (Caibarien, Matanzas, Havana, Bahia Honda). Barbour, Mem. Mus. Comp. Zoöl., **44**, 1914, p. 293. Barbour and Ramsden, Mem. Soc. Poey Havana, **2**, 1916, p. 136. Stejneger, Proc. U. S. Nat. Mus., **53**, 1917, p. 272, figs. 55–57 (distr., color in life). Barbour and Ramsden, Mem. Mus. Comp. Zoöl., **46**, 1919, p. 163, pl. 14, fig. 9 (Cuba, generally distributed).

Anolis carolinensis Duméril and Bibron, Erp. Gén., **4**, 1837, p. 120 (part; Cuba). Cocteau, de la Sagra's Hist. Fis. Pol. Nat. Cuba, Hist. Nat., **4**, Rept., 1838, p. 79, pl. 11; French ed., p. 125 (Cuba). Boulenger, Cat. Liz. Brit. Mus., **2**, 1885, p. 43 (part; Cuba).

Anolius porcatus Gray, Cat. Liz. Brit. Mus., 1845, p. 201 (Cuba; Brit. Mus.; MacLeay coll.).

Anolis principalis var. *porcatus* Cope, Proc. U. S. Nat. Mus., **10**, 1887, p. 437 (part; Cuba).

A beautiful and common lizard and one often seen about houses and gardens. The old blue-headed males are splendid creatures. Found all over the island. I have written concerning its relationships (Proc. New Eng. Zoöl. Club., **10**, July 26, 1928, p. 58).

Anolis pulchellus Duméril and Bibron, Erp. Gén., 1837, p. 97 (type locality, Martinique *in errore*). Stejneger, Ann. Rep. U. S. Nat. Mus., 1902 (1904), p. 660, figs. 112–116 (desc., syn., distr.; Virgin Is., Vieques, Porto Rico, Haiti). Barbour, Mem. Mus. Comp. Zoöl., **44**, 1914, p. 295 (crit.); Proc. Biol. Soc. Wash., **30**, 1917, p. 99 (crit.; Virgin Gorda, Tortola, Anegada). Fowler, Publ. Carnegie Inst. Wash., no. 252, 1918, p. 12 (Virgin Is.). Schmidt, Ann. N. Y. Acad. Sci., 28, 1920, p. 189 (distr., relationships).

Another common and widespread terrestrial species.

Anolis quadriocellifer Barbour and Ramsden, Mem. Mus. Comp. Zoöl., **47**, 1919, p. 158, pl. 10, fig. 1 (type locality, Ensenada de Cajon, Cabo San Antonio, western Cuba; C. de la Torre coll.; type in Mus. Comp. Zoöl., 11,867).

Anolis calliurus Ahl, Arch. f. Naturg., **90**, 1924, p. 249 (type locality, Cuba; type, a ♂, in Berlin Mus., from Gundlach coll.)

This species has not been seen since Prof. Carlos de la Torre discovered the small series now in the Museum of Comparative Zoölogy and in the Poey Museum of Havana University.

Anolis richardii Duméril and Bibron, Erp. Gén., **4**, 1837, p. 141 (type locality Tortola, *in errore* for Tobago [certainly]: type 1 ♂ in Paris Mus.; coll. Richard Sr.). Bocourt, Miss. Scient. Mexique, Rept., livr. **2**, 1873, pl. 15, fig. 6 (fig. of head of type from "Martinique" again *in errore de loc.*). Boulenger, Cat. Liz. Brit. Mus., **2**, 1885, p. 37 [Many W. I. locs. *in errore*—synonymy part: probably as to *A. occipitalis* Gray (West Indies); doubtfully *A. stenodactylus* Gray (unrecognizable) (Jamaica)=? *A garmani* juv.]. Günther, Zoöl. Rec., 1887, p. 10. [*A. richardii*=*A. trossulus*+*A. scriptus* (latter *in errore*)]. Boettger, Kat. Rept. Senck. Mus., **1**, 1893, p. 57 [St. Vincent (=*A. griseus*) and Tobago!].

Anolis trossulus Garman, Bull. Essex Inst., **19**, 1887, p. 38; extr. p. 14 (type locality, Grenada, W. I.; types in Mus. Comp. Zoöl., 6,181, coll. Garman; cotype, 39,289, U. S. Nat. Mus.). Barbour, Mem. Mus. Comp. Zoöl., **44**, 1914, p. 280 (crit.); Handbook of Grenada, 1916, p. 239 (habits, color in life; Grenada); Proc. Biol. Soc. Wash., **29**, 1916, p. 222 (Tobago).

A recent photograph of the type of *A. richardii* D. and B. has at last made it possible finally to settle the position of this species which has caused infinite confusion. The citing of its provenance as from "une des iles principales des Antilles" and then mentioning Tortola might well at once arouse suspicion. This increased when Mr. J. L. Peters made a special trip to Tortola and found no lizard of this group. The photograph spoken of above is exactly matched by examples taken by Prof. Hubert Lyman Clark on Tobago—and this island has had a past importance which Tortola never had.

A. richardii is a fine conspicuous lizard with a green body and brown head very common in the Botanical Gardens at St. George's, Grenada. A species so distinct that it cannot be confused with any other and one which may be derived from *A. chrysolepis* of Trinidad.

Anolis ricordii Duméril and Bibron, Erp. Gén., **4**, 1837, p. 167 (type locality, San Domingo, W. I.; type in Mus. Paris; coll. Ricord). Boulenger, Cat. Liz. Brit. Mus., **2**, 1885, p. 22 (San Domingo; Brit. Mus.). Garman, Bull. Essex Inst., **19**, 1887, p. 27; extr. p. 3 (Samaná, San Domingo; Mus. Comp. Zoöl., 5,445, coll. Frazar). Meerwarth, Mitth. Naturh. Mus. Hamburg, **11**, 1900 (1901), p. 21 (color variant; Port-au-Prince). Barbour, Mem. Mus. Comp. Zoöl., **44**, 1914, p. 273 (Santiago de la Vega, San Domingo, coll. Verrill;

and Diquini, Haiti, coll. Mann). Schmidt, Bull. Amer. Mus. Nat. Hist., **44**, 1921, p. 10 (color in life, comp. with *A. cuvieri*). Cochran, Proc. U. S. Nat. Mus., **66**, art. 6, 1924, p. 4 (loc. records).

Eupristis balcatus Cope, Proc. Acad. Nat. Sci. Phila., 1864, p. 168 (type locality, San Domingo; type in Brit. Mus.).

This splendid species seems to be but rarely found. It may be more abundant in the tree tops than where it is more easily visible. The same habits may and probably do account for the variety in collections of both *A. equestris* Merrem and *A. cuvieri* Merrem.

Anolis roquet Ruthven, Occ. Papers Mus. Zoöl. Univ. Mich., 143, July 9, 1923, p. 6 (reëstablishes this name; Martinique).

Lacerta roquet Lacépède, Hist. Nat. Quad. Ovip. Serp., 1788, **1** (synopsis méthod., div. 4).

Lacerta roquet Bonnaterre, Tabl. Enc. Méth., Erp., 1789, p. 54, pl. 9, fig. 5 (type locality, Martinique, W. I.).

Lacerta martinicensis Suckow, Naturg. Thiere, **3**, 1798, p. 139 (based on "Le Roquet").

Iguana bimaculata Latreille, Hist. Nat. Rept., **1**, 1802, p. 273 (part; Martinique; not of Sparrman).

Anolis martinicensis Kuhl, Beitr. Zoöl., **1**, 1820, p. 131.

Anolis cepedii Merrem, Syst. Amph., 1820, p. 45 (Antilles). Garman, Bull. Essex Inst., **19**, 1887, p. 34; extr. p. 10 (Martinique). Barbour, Mem. Mus. Comp. Zoöl., **44**, 1914, p. 277 (Martinique).

Anolis goudotii Duméril and Bibron, Erp. Gén., **4**, 1837, p. 108 (type locality, Martinique, W. I.; Mus. Paris; coll. Goudot). Bocourt, Miss. Scient. Mexique, Zoöl., Rept., livr. **2**, 1873, p. 59, pl. 14, fig. 4 (Martinique; type). Steindachner, Denkschr. Akad. Wiss. Wien., Math.-Nat., **72**, 1902, p. 99 (Fort-de-France, Martinique).

Anolis alligator, Duméril and Bibron, Erp. Gén., 1837, p. 134 (type locality, Martinique; types in Mus. Paris, colls. Plée, Droz).

True *A. roquet* of Martinique has a rich orange yellow dewlap not a pale lemon yellow one as has *A. vincentii* or a gray and yellow one like *A. luciae*.

Anolis rubribarbus Barbour and Ramsden, Mem. Mus. Comp. Zoöl., **47**, 1919, p. 156, pl. 9, figs. 2–3 (type locality, Puerto de Cananova,

near Sagua de Tanamo, Cuba; V. J. Rodriguez coll.; type in Mus. Comp. Zoöl., 11,941).

This species is known only from the types.

Anolis sabanus Garman, Bull. Essex Inst., **19**, 1887, p. 39; extr. p. 15 (type locality, Saba Island, W. I.; types in Mus. Comp. Zoöl., coll. Lagois; cotype, 39,299, U. S. Nat. Mus.). Barbour, Mem. Mus. Comp. Zoöl., **44**, 1914, p. 276.

A beautiful and common species on the dark volcanic rocks of Saba. Its lemon yellow dewlap is very conspicuous. The adult males are heavily spotted, the females and young almost uniform dove gray with a faint occipital pale spot and at times the dark dorsal line seen in so many species.

Anolis sagrei Duméril and Bibron, Erp. Gén., **4**, 1837, p. 149 (quotes in Synonymy Hist. de l'Isle de Cuba, part. Erp., tab. 10 and elsewhere in the same volume remarks regarding the same citation, "Rept. non encore publiés") (type locality, Cuba; types in Paris Mus.; coll. Ricord and de la Sagra). Stejneger, The Bahama Is., 1905, p. 333 (crit.). Barbour, Mem. Mus. Comp. Zoöl., **44**, 1914, p. 286 (distr. in Cuba). Stejneger, Proc. U. S. Nat. Mus., **53**, 1917, p. 271, figs. 52–54 (color in life, habits). Barbour and Ramsden, Mem. Mus. Comp. Zoöl., **47**, 1919, p. 142, pl. 14, fig. 7 (desc., etc.). Barbour, Handbook of Jamaica, 1922, sep. p. 3 (rec. U. S. Nat. Mus. specs. from Jamaica).

Anolis de la sagra Cocteau, in Sagra's Hist. Fis. Pol. Nat. Cuba, (2) 4, Rept., 1838, p. 82 VII, pl. 13; French ed., pp. 131, pl. 13.

Anolis nebulosa Gray, Ann. Mag. Nat. Hist., (1), **5**, 1840, p. 113 (Cuba; not of Wiegmann).

Dactyloa sagrei Fitzsinger, Syst. Rept., 1843, p. 67 (Cuba).

Draconura catenata Gosse, Ann. Mag. Nat. Hist., (2), **6**, 1850, p. 346 (type locality, Bluefields, Jamaica; type in Brit. Mus., coll. Gosse). (This may be *A. lineatopus*).

Anolis sagrei Hallowell, Proc. Acad. Nat. Sci. Phila., 1856, p. 229 (Cienfuegos, Cuba; in Mus. Phila. Acad.; Capt. Baker coll.). Bocourt, Miss. Scient. Mexique, Zoöl., Rept., livr. **2**, 1873, p. 80, pl. 15, fig. 14 (type locality, Cuba; Jamaica).

Anolis sagrae Gundlach, Contrib. Erp. Cubana, 1880, p. 43 (Cuba). Boulenger, Cat. Liz. Brit. Mus., **2**, 1885, p. 40 (Cuba; Jamaica). Cope, Proc. U. S. Nat. Mus., **10**, 1887, p. 436 (New Providence, Bahamas; Abaco). Garman, Bull. Essex Inst., **19**, 1887, p. 47; extr. p. 23 (Caibarien, Matanzas, Havana, Bahia Honda, Cuba). Cope, Proc. Acad. Nat. Sci. Phila., p. 440 (Port Lucea, Jamaica). Meerwarth, Mitth. Naturh. Mus. Hamburg, **11**, 1900 (1901), p. 25. Barbour, Bull. Mus. Comp. Zoöl., **46**, 1904, p. 58 (Little Abaco, Grand Bahama, etc.). Barbour, Bull. Mus. Comp. Zool., **52**, 1910, p. 295 (Jamaica).

The commonest and most widespread of Cuban Anoles and one of the most abundant of the whole group.

Anolis semilineatus Cope, Proc. Acad. Nat. Sci. Phila., 1864, p. 171 (type locality, Hayti; type in Brit. Mus.); Proc. Amer. Philos. Soc., **18**, Aug. 11, 1879, p. 273 (Port-au-Prince, Haiti; Gabb coll.). Boulenger, Cat. Liz. Brit. Mus., **2**, 1885, p. 68, pl. 6, figs. 1–1a (San Domingo). Garman, Bull. Essex Inst., **19**, 1887, p. 49; extr. p. 25 (Samaná, San Domingo; Mus. Comp. Zoöl.; coll. Frazar). Fischer, Jahrb. Hamburg. Wiss. Anst., **5**, 1888, p. 24 (Cape Haytien, Hayti; H. Rolle coll.). Meerwarth, Mitth. Naturh. Mus. Hamburg, **11**, 1900 (1901), p. 26 (Port-au-Prince). Barbour, Mem. Mus. Comp. Zool., **44**, 1914, p. 291 (Samaná, San Domingo; Diquini, Haiti). Schmidt, Bull. Amer. Mus. Nat. Hist., **44**, 1921, p. 10, figs. 4–5 (distr., relationship); ibid., **44**, 1921, p. 556 (Navassa; status).

Another tiny species which was formerly confused with *A. olssoni*, another cursorial and grass living species.

Anolis speciosus Garman, Bull. Essex Inst., **19**, 1887, p. 42; extr. p. 18 (type locality, Marie Galante, W. I.; types in Mus. Comp. Zoöl., 6,172, coll. Richardson). Barbour, Mem. Mus. Comp. Zoöl., **44**, 1914, p. 276.

This species which seems to be a distinct small dark green form, very easily confused with the young of *Anolis asper*, I did not have the good fortune to find on my visit in Feb., 1929.

Anolis spectrum Peters, Monatsber. Akad. Wiss. Berlin, 1863, p. 136 (locality, Cuba). Bocourt, Miss. Scient. Mexique, Zoöl., Rept., livr. **3**, 1874, pl. 16, fig. 24. Gundlach, Ann. Soc. Hist. Nat. Madrid,

1875, p. 357. Gundlach, Contrib. Erp. Cubana, 1880, p. 51 (Matanzas and Cardenas, Cuba). Boulenger, Cat. Liz. Brit. Mus., **2**, 1885, p. 69. Barbour, Mem. Mus. Comp. Zoöl., **44**, 1914, p. 291 (crit.). Barbour and Ramsden, Mem. Soc. Poey Havana, **2**, 1916, p. 135; Mem. Mus. Comp. Zoöl., **47**, 1919, p. 149, pl. **7**, fig. 5.

This strange little species eluded search for so long that we almost concluded that it must have been based on an aberrant specimen of *A. alutaceus* Cope. It has now been found to aestivate completely and to be not uncommon during the rainy season over much of Central Cuba. Once seen it is never forgotten and is very distinct. It is linked with *Anolis semilineatus* Cope of Haiti, but this species has been taken at all times of the year.

Anolis stratulus Cope, Proc. Acad. Nat. Sci. Phila., 1861, p. 209 (type locality, St. Thomas; type [7 ex.], 7,794–8,000, in Acad. Nat. Sci. Phila.). Stejneger, Ann. Rep. U. S. Nat. Mus., 1902 (1904), p. 651, figs. 105–107 (syn., desc., distr.; Virgin Islands, Culebra, Vieques, Porto Rico, Haiti). Barbour, Mem. Mus. Comp. Zoöl., **44**, 1914, p 274 (crit.); Proc. Biol. Soc. Wash., **30**, 1917, p. 99 (distr.; Tortola, St. Thomas). Fowler, Publ. Carnegie Inst. Wash., no. 252, 1918, p. 11. Schmidt, Ann. N. Y. Acad. Sci., **28**, 1920, p. 188 (distr., stomach contents).

We have nothing to add to the accounts of this rather common and well distributed species.

Anolis terrae-altae Barbour, Proc. Biol. Soc. Wash., **28**, 1915, p. 76 (type locality, Terre d'en Haut, Isles des Saintes, Guadeloupe; G. K. Noble coll.; type in Mus. Comp. Zoöl., 10,627).

Known only from the types taken by Dr. G. K. Noble.

Anolis townsendi Stejneger, Bull. Mus. Comp. Zoöl., **36**, 1900, p. 163 (type locality; Cocos Island, Costa Rica; type, U. S. Nat. Mus., 22, 106, Chas. H. Townsend coll., Albatross Exp. paratype in Museum of Comparative Zoölogy.

Secured in great numbers by some of the recent visitors to Cocos Island.

Anolis vincentii Garman, Bull. Essex Inst., **19**, 1887, p. 46; extr. p. 22 (type locality, St. Vincent, W. I.; types in Mus. Comp. Zoöl.,

6,178–9; coll. Garman; cotypes, 39,301–2, U. S. Nat. Mus.). Barbour, Mem. Mus. Comp. Zoöl., **44**, 1914, p. 278 (crit.).

Anolis trinitatis (part) Barbour, Mem. Mus. Comp. Zoöl., **44**, 1914, p. 28.

Anolis alligator var. *vincentii* Boulenger, Proc. Zoöl. Soc. London, 1891, p. 355 (St. Vincent; Brit. Mus.; coll. Smith). Müller, Verh. Naturf. Ges. Basel, 10, **1**, 1892, p. 211 (St. Vincent; Mus. Basel).

On my recent visit to St. Vincent (March, 1929) I saw no Anoles but the island was extraordinarily dry except in the highlands. In most of the Antilles the Anoles are most common in the lowland areas. Mr. J. L. Peters, however, has supplied me with a water-color sketch of the pale lemon dewlap of this species.

Anolis vincentii differs from *A. gentilis* of the Grenadines and Grenada (q.v.) and from *A. aeneus* of Barbados and Trinidad.

Anolis wattsii Boulenger, Ann. Mag. Nat. Hist., (6), **14**, Nov., 1894, p. 375 (type locality, Antigua, W. I.; type in Brit. Mus.; coll. Watts). Barbour, Mem. Mus. Comp. Zoöl., **44**, 1914, p. 286.

A lovely and delicate little species much less abundant than *Anolis antiquae*. It occurs on the igneous rock outcrops apparently almost entirely. The male is mahogany brown with a russet head and a brilliant and large pale orange dewlap. The female looks much like a slender and narrow-headed female of *Anolis sagrei* with the dorsal rhomb and pale throat.

This species is found on St. Kitts, Nevis, and St. Eustatius as well as Antigua.

ADDENDUM

Since this paper was presented for publication Mr. Karl P. Schmidt's excellent paper on "Amphibians and Land Reptiles of Porto Rico, with a List of Those Reported from the Virgin Islands" has appeared. In this treatise the Anoles are well described and there is much information concerning their distribution and habits. The following references are pertinent:

Anolis cuvieri Merrem; Schmidt, Scient. Survey Porto Rico and the Virgin Is., N. Y. Acad. Sci., **10**, pt. 1, p. 77–80, figs. 27–28; also p. 152.

Anolis cristatellus Duméril & Bibron; Schmidt, l.c., p. 80–85, figs. 27–28, also p. 152.
Anolis gundlachi Peters; Schmidt, l.c., p. 85–87, figs. 27–28.
Anolis stratulus Cope; Schmidt, l.c., p. 87–89, fig. 27, also p. 152.
Anolis evermanni Stejneger; Schmidt, l.c., p. 90–92, fig. 27.
Anolis pulchellus Duméril & Bibron; Schmidt, l.c., p. 92–96, figs. 27–29, also p. 152.
Anolis krugi Peters; Schmidt, l.c., p. 96–99, fig. 29.
Anolis poncensis Stejneger; Schmidt, l.c., p. 99–101, fig. 29.
Anolis acutus Hallowell; Schmidt, l.c., p. 152.

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TYPES OF BIRDS NOW IN THE MUSEUM OF COMPARATIVE ZOÖLOGY

By Outram Bangs

CAMBRIDGE, MASS., U. S. A.:
PRINTED FOR THE MUSEUM
March, 1930

PUBLICATIONS

OF THE

MUSEUM OF COMPARATIVE ZOÖLOGY

AT HARVARD COLLEGE.

There have been published of the BULLETIN, Vols. I to LIV, LVI to LXV, LXVII to LXIX; of the MEMOIRS, Vols. I to LI.

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No. 4.— *Types of Birds Now in the Museum of Comparative Zoölogy*

By Outram Bangs

There are now in the Museum of Comparative Zoölogy the holotypes or cotypes of 1,241 species or subspecies of birds. These are divided among the following authors: —

Allen, G. M.	1
Allen, J. A.	6
Audubon, J. J.	2
Austin, O. L., Jr.	2
Baird, S. F.	1
Bangs, O.	233
Bangs, O., and Barbour, T.	10
Bangs, O., and Peck, M. E.	4
Bangs, O., and Penard, T. E.	45
Bangs, O., and Bradlee, T. S.	4
Bangs, O., and Noble, G. K.	10
Bangs, O., and Peters, J. L.	29
Bangs, O., and Phillips, J. C.	16
Bangs, O., and Zappey, W. R.	6
Barbour, T.	3
Barbour, T., and Brooks, W. S.	2
Barbour, T., and Peters, J. L.	2
Barrows, W. B.	1
Boissonneau, A.	10
Bonaparte, C. L.	7
Brewster, W.	63
Brewster, W., and Bangs, O.	2
Boucard, A.	2
Brooks, W. S.	11
Bryant, H.	16
Cabot, S.	12
Carriker, M. A.	2
Cassin, J.	1
Chadbourne, A. P.	1
Chapin, J. P.	1
Chapman, F. M.	4
Clark, A. H.	7
Cole, L. J.	1

Coues, E. 5
Delessert, E. 1
d'Orbigny, A. 4
d'Orbigny, A., and Lafresnaye, F. de 43
Dwight, J. 2
Friedmann, H. 23
Gmelin, J. F. 1
Gould, J. 1
Gray, G. R. 1
Grinnell, J. 3
Griscom, L. 23
Guérin-Meneville, F. H. 15
Harper, F. 1
Hartert, E. 1
Howe, R. H. 3
Howe, R. H., and King, Leroy 2
Jeffries, J. A. 1
Kennard, F. H. 2
Kennard, F. H., and Peters, J. L. 2
Lafresnaye, F. de 269
Lafresnaye, F. de and d'Orbigny, A. 1
La Touche, J. D. 84
Layard, E. L., and E. L. C. 1
Léotaud, A. 1
Maynard, C. J. 10
Mearns, E. A. 7
Meyer, A. B., and Wiglesworth, L. W. 1
Miller, W. de W., and Griscom, L. 1
Muir, F., and Kershaw, J. C. 1
Nelson, E. W. 3
Nichols, J. T. 1
Oberholser, H. C. 5
Ord, G. 1
Peale, T. R. 37
Penard, T. E. 9
Penard, F. A., and A. P. 1
Peters, J. L. 29
Peters, J. L., and Griscom, L. 4
Phillips, J. C. 7
Ridgway, R. 22
Sarudny, N. A. 1

Schlegel, H.	1
Sclater, P. L.	2
Scott, W. E. D.	2
Sharpe, R. B.	1
Slater, H. H.	3
Sushkin, P. P.	1
Swann, H. K.	15
Thayer, J. E., and Bangs, O.	41
Todd, W. E. C.	2
Townsend, J. K.	1
Townsend, C. W.	1
Verreaux, J.	2
Verreaux, J., and E.	1
van Rossem, A. J.	1
Van Tyne, J.	1
Verrill, A. E.	1
Wells, T.	1
Wetmore, A., and Peters, J. L.	3
Wilson, A.	14

In the accompanying lists I adhere strictly to the well-known definition of type and cotype. When an author specifies a certain individual as his type or has one specimen from which he describes, then there is a holotype, or as it is called here, following the usual custom of ornithologists, a type. On the other hand, when an author describes from several specimens, and does not himself designate any one as his type, all of the original specimens from the type locality are of equal importance, and all are cotypes. No one of such specimens can afterwards be selected by someone else, and called *the* type (as has frequently been done by Ridgway in Birds of North and Middle America). Some authors have followed the very bad practice of designating a male and a female type, in which case both must be listed as cotypes.

Neotypes I have no patience with. I have listed two in the following pages, but consider them of little importance. Both are by Coues, who described the Florida blue jay and the Florida bob-white without mention of any specimens in particular, and some time afterward asked his friend Brewster to select types. This Mr. Brewster did, labeling them "types."

Ornithologists, unlike other systemists, have in the past at least, not considered the paratype of importance. For this reason, as now

in most instances it would be impossible to distinguish them, I make no attempt to list paratypes.

In 1909 I came to the museum to take charge of the birds. Nominally Mr. Brewster was curator, but practically I was in charge. The collection of my brother E. A. Bangs and myself, containing a number of types, came with me. There were then, in the old collection, a few types by J. A. Allen, Ridgway and others. The Bryant collection, including the collections of both Dr. H. Bryant and his son W. S. Bryant, had just come before me, thanks to the efforts of Dr. Henry B. Bigelow, grandson of Dr. Bryant. It contained most of the types or cotypes of the forms described by Dr. Bryant, although some of these had after Dr. Bryant's death, been presented to other institutions by Mrs. Bryant.

A few years later the Boston Society of Natural History decided to limit its activities to New England, and turned over to the Museum of Comparative Zoölogy all other material. In this way the Lafresnaye Collection, the Cabot Collection and a set of specimens from the famous old United States Exploring Expedition, containing a number of types and cotypes of T. R. Peale, came to us.

In 1919 William Brewster died, and his fine collection of North American birds, containing seventy-nine types, came to the Museum by bequest.

The Swann collection of hawks with the types of fifteen species or subspecies was purchased and presented to the Museum by Thomas Barbour.

A few years later, through the generous interest of a number of friends of the Museum, the La Touche collection of the birds of eastern China was secured. This well-known collection, made with the greatest care by La Touche during nearly forty years of residence in China, contains, besides unrivaled series of skins of nearly every species, upwards of eighty types.

The collection of Thomas E. Penard, wholly of Surinam birds, has now been purchased by the Museum. While this adds a number of species, all of the types it contained had already been presented to the Museum by Mr. Penard.

And so with expeditions to various parts of the world, made possible by the financial support of Dr. Thomas Barbour, Colonel John E. Thayer, Dr. John C. Phillips, Professor Theodore Lyman, Mr. F. R. Wulsin, Mr. F. H. Kennard, Mr. Charles P. Curtis and others, the collection of birds has grown from about 40,000 skins in 1909 to its present numbers of upward of 200,000.

A word or two of explanation must be said about the Lafresnaye Collection. Mr. T. E. Penard and I spent much time in going over the specimens thoroughly and sorting out all types that we could find. We had intended to publish a list of the types with an account of Lafresnaye's scientific career, but it now seems best to include the Lafresnaye types with the others contained in the Museum. To Penard, however, I am much indebted for his large share in the work. We still hope, at some future time, to publish an account of Lafresnaye himself and of his scientific activities, for which we have much material.

Lafresnaye had in his cabinet, besides the types of birds described by himself, quite an array of actual types of others — probably more than we have been able definitely to place as such. He had a few by Sclater, Bonaparte, Verreaux, Léotaud and Delessert. He also purchased the birds described by Boissonneau in the article (Rev. Zoöl., 1840, pp. 66–71), and the collection still contains the types of ten of the twelve species there described. There is evidence that the types of the other two — *Tanagra assimilis* and *Tanagra pallidinucha* — were in the collection at one time, but were subsequently destroyed or discarded. Lafresnaye had intended to be joint author with Boissonneau in this article (cf. Rev. Zoöl., 1848, p. 10), but changed his mind.

The types of four of the nine Cuban birds described by d'Orbigny in his *Birds of Cuba* (La Sagra, Hist. Phys. Pol. et Nat. de L'Isle de Cuba, Paris, 1848) are in the Lafresnaye Collection. This is made perfectly clear from the current literature and by Lafresnaye's written labels for the specimens.

More important still is the fact that Lafresnaye acquired the types of the fifteen species of Abyssinian birds described by Guérin-Menville. For all of these Lafresnaye wrote similar labels, and the evidence of their being the actual types is unimpeachable. I think there is no doubt that most if not all of the birds listed by Guérin and Lafresnaye in Ferret et Galinier's *Voyage en Abyssinie*, are also in the Lafresnaye Collection, but unfortunately Lafresnaye's labels, except for the types, do not make this clear.

Lafresnaye had also in his cabinet a set of the birds collected by d'Orbigny during his voyage in America. How these came into his possession I do not know, but his series contains many cotypes and some types. The claim of each one to being a type or cotype, has been at my request, carefully considered by Dr. Hellmayr, and in every case where one is so claimed, it is done with his approval.

The types of a few of the species described by Lafresnaye, which apparently should be in the collection, cannot now be found. This,

however, is not surprising, as types were not valued formerly as they are today, and if poor specimens, or damaged from one cause or another, were very likely to be discarded and replaced.

Lafresnaye was a much better systematic ornithologist than the record of the synonyms made by him would indicate. If one glances at the names in the following list one will see that more than half of those that go into synonymy do so by months or possibly by a year or two only.

In Lafresnaye's time the greatest source of new birds was the enormous supply of "trade skins" constantly pouring into the hands of the Paris dealers. While what we call luck seemed always against him, it must be remembered that Lafresnaye lived in the country, in those days a real journey away from Paris, and, therefore, was often just a little later than some one else in securing some new bird. Also, I fancy, published descriptions were slow in reaching him. Several times I have read a complaint to that effect written by him on a label.

In the bird rooms of the Museum now are stored the private collections of Mr. A. C. Bent and of Mr. F. H. Kennard. These are kept separate from the general collection, but are available for study, and eventually will become part of the Museum collection. Besides Mr. Bent and Mr. Kennard, who work mostly on their own collections, the working force in the bird department is made up of O. Bangs, J. L. Peters, and J. C. Phillips. Mr. Ludlow Griscom, now research curator of zoölogy in the Museum, whose favorite field is ornithology, also does a good deal of work in the bird department.

Harvard College now has a regular course in ornithology given by Dr. Glover M. Allen, and his best students are naturally attracted to the bird rooms, and lately we have had working with us such promising young ornithologists as J. Van Tyne and O. L. Austin, Jr.

In the following list I have done as Hartert did in the List of Types at Tring, and have marked with a dagger those names that it now seems to me must surely go into synonymy.

TINAMIDAE

Tinamus major saturatus Griscom

Tinamus major saturatus Griscom, Bull. Mus. Comp. Zoöl., **69**, 1929, p. 150.

Type.— No. 140,451, ♂; Eastern Panama, Cana; 18 April, 1928; Rex R. Benson.

CRYPTURUS SOUI MUSTELINUS Bangs

now CRYPTURELLUS SOUI MUSTELINUS (Bangs)

Crypturus soui mustelinus Bangs, Proc. Biol. Soc. Washington, **18**, 1905, p. 151.

Type.— No. 115,002, ♀; Colombia, Santa Marta Mountains; 4 February, 1898; W. W. Brown.

CRYPTURUS SOUI PANAMENSIS Carriker

now CRYPTURELLUS SOUI PANAMENSIS (Carriker)

Crypturus soui panamensis Carriker, Ann. Carnegie Mus., **6**, 1910, p. 379.

Type.— No. 107,055, ♀; Panama, Loma del Leon; 25 March, 1900; W. W. Brown.

CRYPTURORNIS CINNAMOMEUS PRAEPES Bangs and Peters

now CRYPTURELLUS CINNAMOMEUS PRAEPES (Bangs and Peters)

Crypturornis cinnamomeus praepes Bangs and Peters, Bull. Mus. Comp. Zoöl., **67**, 1927, p. 472.

Type.— No. 120,855, ♂; Costa Rica, Bolson; 13 December, 1907; C. F. Underwood.

CRYPTURELLUS TATAUPA INOPS Bangs and Noble

Crypturellus tataupa inops Bangs and Noble, Auk, **35**, 1918, p. 445.

Type.— No. 80,123, ♂; Peru, Perico; 10 September, 1916; G. K. Noble.

NOTHURA AGASSIZI Bangs

now NOTHURA MACULOSA AGASSIZI Bangs

Nothura agassizi Bangs, Proc. Biol. Soc. Washington, **23**, 1910, p. 107.

Type.— No. 24,295; Peru, Lake Titicaca; (January 1 to March 5), 1875; S. Garman.

MEGAPODIIDAE

MEGAPODIUS CUMINGII TOLUTILIS Bangs and Peters

Megapodius cumingii tolutilis Bangs and Peters, Occ. Papers Bost. Soc. N. H., **5**, 1927, p. 235.

Type.— No. 235,861, ♀; Maratua Island, Dutch Borneo; E. Mjöberg.

CRACIDAE

Penelope perspicax Bangs

Penelope perspicax Bangs, Proc. Biol. Soc. Washington, **24**, 1911, p. 187.

Type.— No. 123,606, ♀; Colombia, Bitaca Valley, San Luis; 5 June, 1908; M. G. Palmer.

Ortalis vetula intermedia Peters

Ortalis vetula intermedia Peters, Auk, **30**, 1913, p. 371.

Type.— No. 60,644, ♂; Mexico, Quintana Roo, Camp Mengel; 20 January, 1912; J. L. Peters.

† Ortalis struthopus Bangs

= Ortalis cinereiceps cinereiceps (Gray)

Ortalis struthopus Bangs, Proc. New Eng. Zoöl. Club, **2**, 1901, p. 61.

Type.— No. 104,883, ♂; San Miguel Island, Pearl Islands, Bay of Panama; 31 July, 1901; W. W. Brown.

Ortalida cinereiceps Gray, Hand List of Birds Br. Mus., Gallinae, 1867, p. 12.

TETRAONIDAE

Lagopus lagopus koreni Thayer and Bangs

Lagopus lagopus koreni Thayer and Bangs, Proc. New Eng. Zoöl. Club, **5**, 1914, p. 4.

Type.— No. 64,074, ♂; Arctic Siberia, Kolyma Delta; 12 June, 1912 J. Koren.

Sserebrowsky (Jour. f. Orn., **74**, 1926, p. 511) recognizes *koreni*, and gives it a wide distribution in northern Siberia.

Some time ago Peters and I in going over a large amount of material had come to regard this form, as well as others, that lie in the direct circumpolar distribution of the species, as very slender — perhaps too slender — subspecies. Some peripheral forms, such as *major*, *brevirostris*, *alexandrae* etc., must of course stand, but does it serve any useful purpose formally to recognize by name a number of contiguous races, that are so alike that their characters are at best but average ones, which continually overlap through individual variation?

Lagopus welchi Brewster

now Lagopus mutus welchi Brewster

Lagopus welchi Brewster, Auk, **2**, 1885, p. 194.

Cotype.— No. 208,246, ♂; Newfoundland; 25 June, 1883; G. O. Welch.

Cotype.— No. 208,248, ♀; Newfoundland; 19 May, 1883; G. O. Welch.

† Canachites canadensis labradorius Bangs

= Canachites canadensis canadensis (Linné)

Canachites canadensis labradorius Bangs, Proc. New Eng. Zoöl. Club, **1**, 1899, p. 47.

Type.— No. 101,501, ♀; Labrador, Hamilton Inlet; 31 July, 1895; C. H. Goldthwaite.

Cupidonia pinnata Brewster

now Tympanuchus cupido pinnata (Brewster)

Cupidonia pinnata Brewster, Auk, **2**, 1885, p. 82.

Cotype.— No. 202,689, ♂; South Dakota, Vermilion; 20 July, 1877.

Cotype.— No. 202,690, ♀; South Dakota, Vermilion; 20 July, 1877.

It seems to me that all systematists must now agree that Brewster's name and not *americanus* of Reichenbach (Nat. Syst. Vög., 1852, p. 29) must be used for the western "Prairie Chicken." Ridgway was very ill advised in discarding Brewster's certain name for such a name as Reichenbach's.

I wish Professor Gross had insisted on adopting Brewster's name in his fine Monograph of the Heath Hen (Mem. Bost. Soc. Nat. Hist., **6**, no. 4, 1928) instead of making it perfectly clear that this should be done, and then not doing it. On page 562 Gross discusses the question fully, the principal points of which are: — Reichenbach's name was based on two tiny figures of his own and a larger figure copied from Wilson's plate of a pinnated grouse of some sort, from the barrens of Kentucky. Neither the small figures nor the one taken from Wilson are identifiable as to subspecies. In his text Reichenbach refers only to Brisson, who in turn quotes Catesby, who dealt only with the eastern form — *cupido*. The bird of the barrens of Kentucky, the one figured by Wilson, has long been extinct, and we have no knowledge as to

which form it was, but Gross thinks, judging by the character of the country, it was probably the eastern *cupido*.

Reichenbach's name is therefore not a composite name, but as far as human knowledge can ever go, applies only to the eastern bird, and Ridgway never should have applied it to the western form to supercede Brewster's certain *pinnata*.

Bonasa umbellus thayeri Bangs

Bonasa umbellus thayeri Bangs, Auk, **29**, 1912, p. 378.

Type.— No. 111,453, ♂; Nova Scotia, Digby; 9 October, 1892; O. Bangs.

PHASIANIDAE

Francolinus schuetti zappeyi Mearns

now Francolinus squamatus zappeyi Mearns

Francolinus schuetti zappeyi Mearns, Smith. Misc. Coll., **56**, no. 20, 1911, p. 4.

Type.— No. 56,122; British East Africa, Lake Victoria Nyanza; 10 March, 1910; W. R. Zappey.

Arboricola rufogularis euroa Bangs and Phillips

Arboricola rufogularis euroa Bangs and Phillips, Bull. Mus. Comp. Zoöl., **58**, 1914, p. 268.

Type.— No. 61,841, ♂; Yunnan, Mengtsz; 18 March, 1911; Kobayashi.

† Ptilopachus petrosus keniensis Mearns

= Ptilopachus petrosus florentiae Og.-Grant

Ptilopachus petrosus keniensis Mearns, Smith. Misc. Coll., **56**, no. 20, 1911, p. 5.

Type.— No. 56,123, ♂; British East Africa, Hills west of Mount Kenia; 28 July, 1909; G. M. Allen.

Ptilopachus florentiae Og.-Grant, Bull. Brit. Orn. Club, **10**, 1900, p. 107.

† Bambusicola oleagina Bangs and Phillips

= Bambusicola fytchii fytchii Anderson

Bambusicola oleagina Bangs and Phillips, Bull Mus. Comp. Zoöl., **58**, 1914, p. 268.

Type.— No. 61,837, ♂; Yunnan, Mengtsz; 12 December, 1910; Kobayashi.

Bambusicola fytchii Anderson, P. Z. S., 1871, p. 214, pl. 11.

† Francolinus nivosus Delessert

= Galloperdix lunulata (Valenciennes)

Francolinus nivosus Delessert, Mag. de Zoöl., 1840, Ois., p. 18.

Cotype.— No. 76,031, ♂; Lafresnaye Coll., no. 7181.

Cotype.— No. 76,032, sex ? [= ♂]; Lafresnaye Coll., no. 7,180, "inde, Pondichery."

Perdix lunulata Valenciennes, Dict. Sci. Nat., **38**, 1825, p. 446.

The female described by Delessert we do not find in the Lafresnaye Collection. The two males, which were evidently bought by the Baron from Delessert at the time, bear lengthy labels written by Lafresnaye with the "nob." which he invariably used, when he was in some way concerned in naming the species. In this instance I think he simply suggested to Delessert the name used for the species.

Ithagenis wilsoni Thayer and Bangs

Ithagenis wilsoni Thayer and Bangs, Mem. Mus. Comp. Zoöl., **40**, 1912, p. 139.

Type.— No. 52,366, ♂; Western Szechuan, Washan Mountain; 2 November, 1908; W. R. Zappey.

I still have no idea what to do with this name! When he visited Washan Mountain, Weigold took only the true *Ithagenis geoffroyi* Verreaux there, and tells me that the mountain is hardly lofty enough to hold two altitudinal forms. When he was here, I showed Weigold the two specimens of *I. wilsoni*, and he simply remarked, "I never saw anything like that there." If Zappey had taken but one example I should not now hesitate to call it a dwarf; but two individuals just alike I am hardly prepared to dispose of in this easy way.

Ceriornis caboti Gould

now Tragopan caboti (Gould)

Ceriornis caboti Gould, P. Z. S., 1857, p. 161.

Type.— No. 73,213; [China]; from the Cabot Collection.

† Phasianus colchicus rothschildi La Touche

= Phasianus colchicus elegans Elliot

Phasianus colchicus rothschildi LaTouche, Bull. B. O. C., **42**, 1921, p. 54.

Type.— No. 131,217, ♂; Yunnan, Mengtsz; 31 March, 1921; La Touche Collection.

Phasianus elegans Elliott, Ann. Mag. Nat. Hist. (4), **6**, 1870, p. 312.

I wholly agree with Rothschild (Nov. Zoöl., **33**, 1926, p. 207) that *P. c. rothschildi* is in no way different from *P. c. elegans*. The supposed difference in color is wholly due to the Mengtsz birds that La Touche had being in worn and somewhat faded condition of plumage. The male which Phillips and I recorded from Mengtsz is an immature, that had mostly acquired the feathers of the adult dress, which are in color *exactly* similar to those of Szechuan examples.

Phasianus colchicus hemptinnii La Touche

Phasianus colchicus hemptinnii La Touche, Bull. B. O. C., **40**, 1919, p. 51.

Type.— No. 131,219, ♂; Hupeh; Mopanchow, Sungtze district; 24 February, 1919; La Touche Collection.

As pointed out by La Touche (Ibis, July, 1922, footnote, p. 465) Hartert was, of course, entirely wrong in placing *hemptinnii* as a synonym of *torquatus*. The real relationship of *hemptinnii*, a hill bird with white eyebrows, is with *decollatus*. I have seen but few specimens of true *decollatus* and recognize *hemptinnii*, of which we have a long series from the hills of Hupeh, largely because the late Professor Sushkin, who shortly before his death was carefully studying the true pheasants, assured me that it is a perfectly well marked form.

MELEAGRIDAE

Meleagris gallopavo osceola Scott

Meleagris gallopavo osceola Scott, Auk, **7**, 1890, p. 376.

Type.— No. 248,599, ♂; Florida, Tarpon Springs; 16 March, 1887; W. E. D. Scott.

ODONTOPHORIDAE

Callipepla squamata pallida Brewster

Callipepla squamata pallida Brewster, Bull. Nutt. Orn. Club, **6**, 1881, p. 72.

Cotype.— No. 205,195, ♂; Arizona, San Pedro River; 13 March, 1880; F. Stephens.

Cotype.— No. 205,196, ♀; Arizona, Fort Bowie; 2 April, 1880; F. Stephens.

Callipepla squamata castanogastris Brewster

Callipepla squamata castanogastris Brewster, Bull. Nutt. Orn. Club, **8**, 1883, p. 34.

Cotype.— No. 206,547, ♂; Texas, Rio Grande City; 11 November, 1880; M. A. Frazar.

Cotype.— No. 206,548, ♀; Texas, Rio Grande City; 16 November, 1880; M. A. Frazar.

Lophortyx californica achrustera Peters

Lophortyx californica achrustera Peters, Proc. New Eng. Zoöl. Club, **8**, 1923, p. 79.

Type.— No. 218,093, ♂; Lower California, La Paz; 4 February, 1887; M. A. Frazar.

Ortyx virginianus floridanus Coues

now Colinus virginianus floridanus (Coues)

Ortyx virginianus var. *floridanus* Coues, Key to North Am. Birds, 1872, p. 237.

Neotype.— No. 5,337, ♂; Florida, Enterprise; 4 March, 1869; Allen and Marcy.

This specimen bears the following inscription on its original label, in Brewster's hand: — "selected as type, March 9, 1898, by W. Brewster, at request of Dr. Coues."

† Colinus bahamensis Maynard

= Colinus virginianus floridanus (Coues)

Colinus bahamensis Maynard, App. to Cat. of Birds West Indies, 1899, p. 33.

Cotype.— No. 103,356, ♂; Bahama Islands, Nassau; 11 May, 1897; C. J. Maynard.

Cotype.— No. 103,357, ♀; Bahama Islands, Nassau; 1 April, 1897; C. J. Maynard.

Ortyx virginianus var. *floridanus* Coues, Key to North Am. Birds, 1872, p. 237.

The bob-white was probably introduced many years ago into the Bahamas; at all events, the five skins now before me cannot be told in any way from birds from south Florida.

Colinus virginianus insularis Howe

Colinus virginianus insularis Howe, Proc. Biol. Soc. Washington, **17**, 1904, p. 165.

Type.— No. 246,670, ♂; Florida, Key West; 5 July, 1888; J. W. Atkins.

So far as can be judged by the single known specimen, the Key West bob-white was a recognizable island form, differing from *floridanus* of south Florida chiefly in its much smaller size. This bird is now quite extinct. The city of Key West has spread over most of the island, and all brush land and cover is gone. Mr. J. W. Atkins, who has been stationed on the island for many years, has not seen or heard a bob-white since 1888.

Colinus virginianus thayeri Bangs and Peters

Colinus virginianus thayeri Bangs and Peters, Bull. Mus. Comp. Zoöl., **68**, 1928, p. 386.

Type.— No. 238,200, ♂; Mexico, Oaxaca, Chivela; 29 March, 1927; W. W. Brown.

† Odontophorus guianensis chapmani Griscom

= Odontophorus guianensis marmoratus Gould ?

Odontophorus guianensis chapmani Griscom, Bull. Mus. Comp. Zoöl., **69**, 1929, p. 153.

Type.— No. 140,453, ♀; Eastern Panama, Cana; 22 July, 1928; Rex R. Benson.

Ortyx (Odontophorus) marmoratus Gould, P. Z. S., 1843, p. 107.

Chapman (Am. Mus. Novit., no. 380, 1929, pp. 4–7) in discussing the races of *O. guianensis*, is now inclined to lump both his *panamensis* and Griscom's *chapmani* with *marmoratus*.

Odontophorus castigatus Bangs

now Odontophorus (guianensis?) castigatus Bangs

Odontophorus castigatus Bangs, Auk, **18**, 1901, p. 356.

Type.— No. 107,642, ♂; Panama, Divala; 8 December, 1900; W. W. Brown.

ODONTOPHORUS MELANOTIS VERECUNDUS Peters

Odontophorus melanotis verecundus Peters, Bull. Mus. Comp. Zoöl., **69**, 1929, p. 404

Type.— No. 136,509, ♀; Honduras, Lancetilla; 10 February, 1928; J. L. Peters.

† ODONTOPHORUS BALIOLUS Bangs

= ODONTOPHORUS PARAMBAE PARAMBAE Rothschild

Odontophorus baliolus Bangs, Proc. Biol. Soc. Washington, **23**, 1910, p. 71.

Type.— No. 123,432, ♀; Colombia, Rio Dagua, Naranjito; 20 June, 1908; M. G. Palmer.

Odontophorus parambae Rothschild, Bull. B. O. C., **7**, 1897, p. 6.

RHYNCHORTYX CINCTUS PUDIBUNDUS Peters

Rhynchortyx cinctus pudibundus Peters, Bull. Mus. Comp. Zoöl., **69**, 1929, p. 405.

Type.— No. 136,511, ♀; Honduras, Lancetilla; 17 January, 1928; J. L. Peters and E. Bangs.

TURNICIDAE

TURNIX SYLVATICA ALLENI Mearns

Turnix sylvatica alleni Mearns, Smith. Misc. Coll., **56**, no. 20, 1911, p. 5.

Type.— No. 56,126, ♂; British East Africa, Plains of Guaso Nyiro; 20 July, 1909; G. M. Allen.

PTEROCLIDIDAE

EREMIALECTOR DECORATUS LOVERIDGEI Friedmann

Eremialector decoratus loveridgei Friedmann, Proc. New Engl. Zoöl. Club, **10**, 1928, p. 79.

Type.— No. 133,348, ♂; Tanganyika Territory, Dodoma; 5 December, 1918; A. Loveridge.

COLUMBIDAE

SPHENOCERCUS MEDIOXIMUS Bangs

now SPHENURUS PERMAGUS MEDIOXIMUS (Bangs)

Sphenocercus medioximus Bangs, Bull. Mus. Comp. Zoöl., **36**, 1901, p. 261.

Type.— No. 37,349, ♂; Ishigaki Island, Loo-Choo Islands; 9 March, 1899; I. Zensaku.

Sphenocercus sphenurus yunnanensis La Touche

Sphenocercus sphenurus yunnanensis La Touche, Bull. B. O. C., **42**, 1921, p. 13.

Type.— No. 131,215, ♂; Yunnan, Lotukow; 14 May, 1921; La Touche Collection.

Ptilinopus marshallianus Peters and Griscom

Ptilinopus marshallianus Peters and Griscom, Proc. New Eng. Zoöl. Club, **10**, 1928, p. 104.

Type.— No. 240,271; Marshall Islands, Ebon Island; 1859; Rev. B. G. Snow.

Ptilinopus coralensis Peale

Ptilinopus coralensis Peale, U. S. Expl. Exped., **8**, 1848, p. 190.

Cotype.— No. 74,425; Polynesia, Paumotu Islands; T. R. Peale.

Our cotype is well preserved and is in good condition. Peale says, "specimens were subsequently obtained during the month of September on most of the low coral islets of the Paumotu Group." Probably therefore other cotypes are still in existence.

† Ptilinopus furcatus Peale

= Ptilinopus purpuratus (Gmelin)

Ptilinopus furcatus Peale, U. S. Expl. Exped., **8**, 1848, p. 191.

Cotype.— No. 74,426; Tahiti; T. R. Peale.

Columba purpurata Gmelin, Syst. Nat., **1**, part 2, 1789, p. 784.

Peale speaks as if he secured many specimens, and undoubtedly others of his cotypes are in existence.

Carpophaga aurorae Peale

now Globicera aurorae (Peale)

Carpophaga aurorae Peale, U. S. Expl. Exped., 1848, p. 201.

Cotype.— No. 74,422; Society Islands; U. S. Expl. Exped.

Our cotype of this pigeon is a good specimen that, although mounted for many years, has been made over again into a skin without any injury.

Columba fasciata vioscae Brewster

Columba fasciata vioscae Brewster, Auk, **5**, 1888, p. 86.

Cotype.— No. 214,138, ♂; Lower California, La Laguna Mt.; 30 May, 1887; M. A. Frazar.

Cotype.— No. 214,139, ♀; Lower California, La Laguna Mt.; 31 May, 1887; M. A. Frazar.

† Zenaida zenaida lucida Noble

= Zenaida aurita zenaida Bonaparte

Zenaida zenaida lucida Noble, Proc. New Eng. Zoöl. Club, **5**, 1915, p. 101.

Type.— No. 66,287, ♂; Virgin Islands, St. Croix; 19 June, 1914; G. K. Noble.

Columba zenaida Bonaparte, Jour. Acad. Nat. Sci., Phila., **5**, 1825, p. 30.

† Zenaida auriculata pallens Bangs and Noble

= Zenaida auriculata hypoleuca Bonaparte

Zenaida auriculata pallens Bangs and Noble, Auk, **35**, 1918, p. 446.

Type.— No. 80,019, ♂; Peru, Huancabamba; 22 August, 1916; G. K. Noble.

Zenaida hypoleuca Bonaparte, Consp. Av., **2**, 1854, p. 83.

Melopelia asiatica australis Peters

Melopelia asiatica australis Peters, Auk, **30**, 1913, p. 372

Type.— No. 121,118, ♂; Costa Rica, Cerro Sta. Maria; 9 January, 1908; C. F. Underwood.

Although placed by Ridgway in synonymy, the southern form of the white-winged dove seems to both Mr. Peters and me to be a perfectly recognizable race.

Streptopelia capicola anceps Friedmann

Streptopelia capicola anceps Friedmann, Proc. New Engl. Zoöl. Club, **10**, 1928, p. 67.

Type.— No. 133,300, ♂; Tanganyika Territory, Kilosa; 12 February, 1921; A. Loveridge.

Dr. Friedmann, thinking that perhaps Reichenow's carelessly proposed name (*Turtur capicola suahelicus* J. f. O., 1921, p. 264) which was overlooked by the Zoölogical Record, and not mentioned by Sclater in the Syst. Avium, might apply to this bird, wrote to Dr. Stresemann, and asked if he would kindly examine the type. Dr. Stresemann replied that *Turtur capicola suahelicus* is a synonym of *Turtur capicola tropica* Reichenow.

Geopelia humeralis gregalis Bangs and Peters

Geopelia humeralis gregalis Bangs and Peters, Bull. Mus. Comp. Zoöl., **67**, 1926, p. 423.

Type.— No. 99,488, ♂; S. W. New Guinea, Wendoe Mer River; 19 April, 1924; T. Jackson.

Scardafella inca dialeucos Bangs

Scardafella inca dialeucos Bangs, Proc. Biol. Soc. Washington, **18**, 1905, p. 152.

Type.— No. 104,796; boundary between Honduras and Nicaragua, 180 miles from Pacific Coast. (Received from a surveyor when at work on the boundary line.)

This form is not recognized by Ridgway. Peters and I (Bull. Mus. Comp. Zoöl., **67**, 1927, p. 472) give our reasons for considering it a perfectly valid subspecies.

Columbigallina jamaicensis Maynard

now Chaemepelia passerina jamaicensis (Maynard)

Columbigallina jamaicensis Maynard, App. Cat. West Ind. Birds, 1899, p. 34.

Cotype.— No. 41,863, ♂
Cotype.— No. 41,864, ♂
Cotype.— No. 41,865, ♂
} Jamaica, Spanishtown; March, 1865; H. Bryant

In his brief diagnosis of the Jamaican form, Maynard says, "Types male and female in the Bryant Collection." There is no female in the Bryant Collection, and the three males listed above as cotypes, to my own personal knowledge, are the ones that Maynard had.

† Columbigallina bermudiana Bangs and Bradlee

= Chaemepelia passerina bahamensis Maynard ?

Columbigallina bermudiana Bangs and Bradlee, Auk, **18**, 1901, p. 250.

Type.— No. 39,134, ♂; Bermuda, Hamilton; 5 February, 1901; T. S. Bradlee.

Columbigallina bahamensis Maynard, Am. Exchange and Mart., Jan, 15, 1887, p. 33.

The Bermuda ground dove is considered by both Ridgway and Todd to be the same as the Bahaman bird. The latter is a rather unsatisfactory subspecies with somewhat unstable characters; if the two forms are thrown together it must be admitted, I think, that the Bermuda bird represents an extreme.

Chamaepelia arthuri Bangs and Penard

Chamaepelia arthuri Bangs and Penard, Bull. Mus. Comp. Zoöl., **62**, 1918, p. 45.

Type.— No. 80,921, ♂; Surinam, vicinity of Paramaribo; 4 March, 1913.

† Chaemepelia rufipennis nesophila Todd

= Chaemepelia rufipennis rufipennis (Bonaparte)

Chaemepelia rufipennis nesophila Todd, Ann. Carn. Mus., **8**, 1913, p. 590, footnote.

Type.— No. 114,322, ♀ [= young male, with sex wrongly determined]; San Miguel Island, Pearl Islands, Bay of Panama; 21 February, 1904; W. W. Brown.

Talpacotia rufipennis Bonaparte, Consp. Avium, **2**, 1854, p. 79.

Columbigallina rufipennis eluta Bangs

now Chaemepelia rufipennis leuta (Bangs)

Columbigallina rufipennis eluta Bangs, Auk, **18**, 1901, p. 257.

Type.— No. 103,947, ♂; Mexico, Sinaloa, Escuinapa; 25 July, 1897; P. O. Simons.

Claravis pretiosa livida Bangs

Claravis pretiosa livida Bangs, Proc. Biol. Soc. Washington, **18**, 1905, p. 153.

Type.— No. 104,056, ♂; Colombia, Rio Cauca; June, 1898; J. H. Batty.

Oena capensis aliena Bangs

Oena capensis aliena Bangs, Bull. Mus. Comp. Zoöl., **61**, 1918, p. 491.

Type.— No. 77,895, ♂; Madagascar, Tulear; 3 August, 1915; F. R. Wulsin.

Leptotila fulviventris angelica Bangs and Penard

Leptotila fulviventris angelica Bangs and Penard, Proc. New Eng. Zoöl. Club, **8**, 1922, p. 29.

Type.— No. 41,839, ♂; Texas, Brownsville; 16 March, 1889; F. B. Armstrong.

Leptotila verreauxi tenella Penard

Leptotila verreauxi tenella Penard, Proc. New Eng. Zoöl. Club, **8**, 1923, p. 35.

Type.— No. 89,294, sex ?; Surinam, Lelydorp; 26 April, 1922.

† Geotrygon martinica digressa Bangs

= Oreopeleia martinica (Linné)?

Geotrygon martinica digressa Bangs, Proc. Biol. Soc. Washington, **18**, 1905, p. 153.

Type.— No. 111,442, ♀ [=♂]; Lesser Antilles, Guadeloupe; 5 September, 1901; purchased of a dealer, collector unknown.

Columba martinica Linné, Syst. Nat., ed. 12, **1**, 1766, p. 283.

The type is an exceptionally big bird, and is very pale below, but unfortunately other Guadeloupe examples do not bear out these characters and are not much like it. I have sometimes wondered if the type might not really have come from some other near-by island, possibly Desirade.

Geotrygon linearis infusca Bangs

now Oreopeleia linearis infusca (Bangs)

Geotrygon linearis infusca Bangs, Proc. New Eng. Zoöl. Club, **1**, 1900, p. 107.

Type.— No. 105,955, ♂; Colombia, Santa Marta region, Chirua; 2 February, 1899; W. W. Brown.

Columbigallina versicolor Lafresnaye

now Geotrygon versicolor (Lafresnaye)

Columbigallina versicolor Lafresnaye, Rev. Zoöl., 1846, September (= November), p. 321.

Type.— No. 75,286 (Lafresnaye coll., no. 7,026); Jamaica.

Lafresnaye wrote two labels for this specimen, the first of which was obviously done when he described the bird; the second, later, when he discovered that the species had already been named by both Temminck and Gosse, they are — 1st "Columbigallina versicolor nob. rev. 1846 p. 321 (Jamaique)"; 2d "Geotrygon Gosse. col. cristata tem. Geotrygon sylvatica Gosse — p. 316, pl. 84 Geophaps versicolor Lafr. rev. 1846, 321–0. Desmurs pl. 47 Jamaique."

Temminck's name was preoccupied, and Lafresnaye antedates Gosse.

Des Murs (Icon. Orn., 1847, pl. 47) considers a specimen in the Paris Museum to be the type of Lafresnaye's description. Des Murs was, however, unaware that Lafresnaye had a specimen himself, which he described, and for which he wrote a label with his significant "nob." on it. This specimen must be regarded as the type.

RALLIDAE

Rallus levipes Bangs

now Rallus elegans levipes Bangs

Rallus levipes Bangs, Proc. New Eng. Zoöl. Club, **1**, 1899, p. 45.

Type.— No. 100,678, ♀; California, Los Angeles Co., Newport Landing; 23 February, 1886; F. Stephens.

Rallus crepitans waynei Brewster

now Rallus longirostris waynei Brewster

Rallus crepitans waynei Brewster, Proc. New Eng. Zoöl. Club, **1**, 1899, p. 50.

Type.— No. 204,220, ♂; Georgia, St. Mary's; 18 March, 1878; W. Brewster.

Rallus longirostris insularum W. S. Brooks

Rallus longirostris insularum W. S. Brooks, Proc. New Eng. Zoöl. Club, **7**, 1920, p. 53.

Type.— No. 82,583, ♂; Florida, Big Pine Key; 20 April, 1920; W. S. Brooks.

Limnopardalis maculatus insolitus Bangs and Peck
now Pardirallus maculatus insolitus (Bangs and Peck)

Himnopardalus (sic) *maculatus insolitus* Bangs and Peck, Proc. Biol. Soc. Washington, **21**, 1908, p. 43.

Type.— No. 116,029, sex ?; British Honduras, Ycacos Lagoon; June, 1907; M. E. Peck.

Limnopardalis maculatus inoptatus Bangs
now Pardirallus maculatus inoptatus (Bangs)

Limnopardalis maculatus inoptatus Bangs, Proc. New Eng. Zoöl. Club, **4**, 1913, p. 90.

Type.— No. 61,101, sex ?; Cuba, Prov. Havana, Jaruco; 14 February, 1913; T. Barbour.

Cyanolimnas cerverai Barbour and Peters

Cyanolimnas cerverai Barbour and Peters, Proc. New Eng. Zoöl. Club, **9**, 12 May, 1927, p. 95.

Type.— No. 236,691, ♂; Cuba, Peninsula de Zapata, Santo Tomas; 8 March, 1927; F. Z. Cervera.

Tricholimnas conditicius Peters and Griscom

Tricholimnas conditicius Peters and Griscom, Proc. New Eng. Zoöl. Club, **10**, 1928, p. 102.

Type.— No. 21,943; Gilbert Islands, Apaiang; 1859; Andrew Garrett.

Aramides cajanea latens Bangs and Penard

Aramides cajanea latens Bangs and Penard, Bull. Mus. Comp. Zoöl., **62**, 1918, p. 41.

Type.— No. 114,297, ♀; San Miguel Island, Pearl Islands, Bay of Panama; 21 February, 1904; W. W. Brown.

Aramides albiventris mexicanus Bangs

Aramides albiventris mexicanus Bangs, Am. Nat., **41**, 1907, p. 187.

Type.— No. 102,281, ♀; Mexico, Vera Cruz, Buena Vista; 4 June, 1901; Colburn and Shufeldt.

Habroptila wallacei G. R. Gray

Habroptila wallacei G. R. Gray, P. Z. S., 1860, p. 365, pl. 172.

Cotype.— No. 140,251; Halmahera; Wallace.

Many years ago a benefactor of the Montreal Natural History Society apparently bought for that organization a number of Wallace's birds, including an example of the Halmahera rail. The material belonging to that society was later transferred to the Redpath Museum of McGill University. Later still the rail was exchanged to us.

Gray in his original description of the species does not say how many examples Wallace took, nor what particular specimen his description was taken from. As is well known, Wallace sold some of his specimens after they were identified, to defray the expenses of his expeditions.

There are two cotypes of *Habroptila wallacei* in the British Museum — possibly others may also exist — but like the types our bird could only have been taken by Wallace, since no one else had taken birds on Halmahera at that early date, so far as I am aware.

Gallinula eurizonoides Lafresnaye

now Euryzona eurizonoides (Lafresnaye)

Gallinula eurizonoides Lafresnaye, Rev. Zoöl., 1845, p. 368.

Type.— No. 74,366 (Lafresnaye coll. 7,746); no data.

Lafresnaye's label for this specimen reads — "Gallinula Eurizonoides, Poule d'eau Eurizonoide nob. rev. 1845-368."

Porzana pusilla intensa Friedmann

Porzana pusilla intensa Friedmann, Proc. New Eng. Zoöl. Club, **10**, 1928, p. 77.

Type.— No. 232,572, ♂; Transvaal, Moorddrift; 15 December, 1924; H. Friedmann.

Sarothura elegans languens Friedmann

Sarothura elegans languens Friedmann, Proc. New Eng. Zoöl. Club, **10**, 1928, p. 69.

Type.— No. 133,271, sex ?; Tanganyika Territory, Uluguru Mts.; 19 May, 1921; A. Loveridge.

Rallus rougetii Guérin

now Rougetius rougetii (Guérin)

Rallus Rougetii Guérin, Rev. Zoöl., 1843, p. 322.

Type.— No. 74,399 (Lafresnaye Coll., no. 7,702); Abyssinia.

Neocrex columbianus Bangs

Neocrex columbianus Bangs, Proc. Biol. Soc. Washington, **12**, 1898, p. 171.

Type.— No. 105,700, ♀ ; Colombia, Santa Marta region, Palomina; 22 May, 1898; W. W. Brown.

† Brachyptrallus ralloides Lafresnaye

= Tribonyx mortieri Du Bus

Brachyptrallus ralloides Lafresnaye, Rev. Zoöl., 1840 (August), p. 232.

Type.— No. 74,401 (Lafresnaye Coll., no. 7,770); no data; purchased by Lafresnaye from Boissonneau.

Tribonyx mortieri Du Bus, Bull. Acad. Roy. Bruxelles, 1840, **1**, p. 214, pl. 11.

Gallinula galeata cerceris Bangs

now Gallinula chloropus cerceris Bangs

Gallinula galeata cerceris Bangs, Proc. New Eng. Zoöl. Club, **4**, 1910, p. 81.

Type.— No. 27,430; Lesser Antilles, St. Lucia; J. Semper.

Gallinula chloropus cachinnans Bangs

Gallinula chloropus cachinnans Bangs, Proc. New Eng. Zoöl. Club, **5**, 1915, p. 96.

Type.— No. 55,538, ♂; Florida, DeSoto Co., Arbuckle Creek; 27 March, 1893; W. H. Phelps.

This is a poorly characterized form, rather doubtfully separable from the West Indian *cerceris*. Wetmore, however (Birds of Porto Rico and the Virgin Islands, p. 345) is inclined to keep the two distinct.

Gallinula chloropus pauxilla Bangs

Gallinula chloropus pauxilla Bangs, Proc. New Eng. Zoöl. Club, **5**, 1915, p. 96.

Type.— No. 123,622, ♀ ; Colombia, Rio Cauca, Guabinas; 17 January, 1908; M. G. Palmer.

Gallinula garmani Allen

now Gallinula chloropus garmani Allen

Gallinula garmani Allen, Bull. Mus. Comp. Zoöl., **3**, 1876, p. 357.

Cotype.— No. 24,348
Cotype.— No. 24,349
Cotype.— No. 24,350
Cotype.— No. 24,351
Cotype.— No. 24,352
Cotype.— No. 24,353
Cotype.— No. 24,354

} Peru, Lake Titicaca; February, 1875; S. Garman

Porphyrio samoensis Peale

now Porphyrio melanotus samoensis Peale

Porphyrio samoensis Peale, U. S. Expl. Exped., 1848, p. 220.

Cotype.— No. 74,364; Samoan Islands; T. R. Peale.

Peale does not say how many specimens he collected, but undoubtedly other cotypes exist besides ours.

Fulica alai Peale

Fulica alai Peale, U. S. Expl. Exped., 1848, p. 224.

Cotype.— No. 74,363; Hawaiian Islands; T. R. Peale.

Peale tells us that he secured four specimens of the Hawaiian coot; the other three cotypes are probably in existence.

COLYMBIDAE

Podilymbus podiceps antillarum Bangs

Podilymbus podiceps antillarum Bangs, Proc. New Eng. Zoöl. Club, **4**, 1913, p. 89.

Type.— No. 61,100, ♀; Cuba, Oriente, Bueycito; 9 March, 1913; Barbour and Rodriguez.

Wetmore (Scientific Survey of Porto Rico and the Virgin Islands, N. Y. Acad. Sci., **9**, 1927, p. 272) recognizes as valid the slightly smaller West Indian breeding form of the pied-billed grebe, in spite of what has been said of it by other authors. The differences in size between North American and West Indian skins is well marked, and I follow Wetmore in retaining the form.

SPHENISCIDAE

† Aptenodytes longicauda Peale

= Pygoscelis adeliae (Hombron and Jacquinot)

Aptenodytes longicauda Peale, U. S. Expl. Exped., 1848, p. 261.

Cotype.— No. 75,684; Antarctic Ocean; T. R. Peale.

Catarrhactes adeliae Hombron and Jacquinot, Ann. Sci. Nat. (2), **16**, 1841, p. 320.

Peale mentions but one specimen; possibly, however, there are other cotypes.

† Aptenodytes magnirostris Peale

= Spheniscus magellanicus (Forster)

Aptenodytes magnirostris Peale, U. S. Expl. Exped., 1848, p. 263.

Type.— No. 75,621; Cape Horn; T. R. Peale.

Aptenodytes magellanica Forster, Comment. Götting., **3**, 1781, p. 143.

Of this species Peale, so he himself says, took but a single specimen.

PROCELLARIIDAE

Oceanodroma castro bangsi Nichols

Oceanodroma castro bangsi Nichols, Auk, **31**, 1914, p. 388.

Type.— No. 112,413, ♀; Galapagos Islands, long. 93° W.; 6 February, 1901; R. H. Beck.

† Procellaria wilsonii Bonaparte

= Oceanites oceanicus (Kuhl)

Procellaria wilsonii Bonaparte, Journ. Nat. Sci. Phil., **3**, 1824, p. 231, pl. 9.

Type.— No. 67,815; no data; from the old Peale Museum.

The specimen from which T. R. Peale made the drawing for Bonaparte.

Procellaria oceanica Kuhl, Beitr., 1820, p. 136.

† Procellaria diabolica Lafresnaye

= Pterodroma hasitata (Kuhl)

Procellaria diabolica Lafresnaye, Rev. Zoöl., 1844, p. 168.

Cotype.— No. 73,221 (Lafresnaye Coll., no. 8,000)
Cotype.— No. 73,222 (Lafresnaye Coll., no. 8,002)
Cotype.— No. 73,219 (Lafresnaye Coll., no. 8,003)
Cotype.— No. 73 220 (Lafresnaye Coll., no. 8,004)
all collected in Guadeloupe by L'herminier.

Procellaria hasitata Kuhl, Beitr., 1820, p. 142.

For one of the cotypes of *diabolica*, no. 73,220, there is a label written I think by L'herminier, which reads — "Pètrel — mauping ou maupingue, Gpe — 9*ber* 1842."

There were originally five cotypes in the Lafresnaye Collection; one of these, no. 8,001, was exchanged in 1886 with Professor Alfred Newton for a specimen of *Pterodroma jamaicensis*.

† Aestrelata scalaris Brewster

= Pterodroma inexpectata inexpectata (Forster)

Aestrelata scalaris Brewster, Auk, **3**, 1886, p. 300.

Type.— No. 205,224, sex ?; New York, Livingston Co.; April, 1880.

Procellaria inexpectata Forster, Descr. Anim. ed. Licht., 1844, p. 204.

Procellaria candida Peale

now Pagodroma nivea candida (Peale)

Procellaria candida Peale, U. S. Expl. Exped., 1848, p. 295.

Cotype.— No. 75,658; Antarctic Ocean; T. R. Peale.

Peale says that "a number of specimens were preserved." Peale's form is recognized by Mathews in Syst. Avium Australasianarum, 1927.

Halobaena murphyi W. S. Brooks

now Halobaena caerulea murphyi W. S. Brooks

Halobaena murphyi W. S. Brooks, Bull. Mus. Comp. Zoöl., **61**, 1917, p. 146.

Type.— No. 70,725; South Georgia, Stromness Bay; 1913.

Dabbene (Hornero, **3**, 1923, p. 126) has reduced this supposed species to a subspecies of *caerulea*.

LARIDAE

† Sterna antarctica Peale

= Sterna hirundinacea Lesson

Sterna antarctica Peale, U. S. Expl. Exped., 1848, p. 280.

Cotype.— No. 75,663; Cape Horn; T. R. Peale.

Sterna hirundinacea Lesson, Traité, 1831, p. 621.

Sterna acuflavida Cabot

now Thalasseus sandvicensis acuflavidus (Cabot)

Sterna acuflavida Cabot, Proc. Bost. Soc. N. H., **2**, 1847, p. 257.

Type.— No. 72,571; Yucatan, Tancah; 25 April, 1842; S. Cabot.

† Sterna bergii boreotis Bangs

= Thalasseus bergii cristatus (Stephens)

Sterna bergii boreotis Bangs, Bull. Mus. Comp. Zoöl., **36**, 1901, p. 256.

Type.— No. 37,301; Loo-Choo Islands, Ishihaki; 15 June, 1899; I. Zensaku.

Sterna cristata Stephens, in Shaw's Gen. Zoöl., **13**, 1825, p. 146.

Sterna teretirostris Lafresnaye

now Procelsterna cerulea teretirostris (Lafresnaye)

Sterna teretirostris Lafresnaye, Rev. Zoöl., 1841, p. 242.

Type.— No. 74,867 (Lafresnaye Coll., no. 8,116); no data.

Mathews (Birds of Australia, **2**, pt. 4, 1912 p. 430,) has designated the Paumotu Group as type locality for Lafresnaye's bird. Lafresnaye wrote a long label for his specimen, which dealt wholly with synonomy, giving no inkling as to from whom he had it or whence it came.

†Megalopterus plumbeus Peale

= Procelsterna cerulea teretirostris (Lafresnaye)

Megalopterus plumbeus Peale, U. S. Expl. Exped., 1848, p. 285.

Cotype.— No. 75,662; Paumotu Islands; T. R. Peale.

Sterna teretirostris Lafresnaye, Rev. Zoöl., 1841, p. 242.

† Anous pullus Bangs

= Anous stolidus pileatus (Scopoli)?

Anous pullus Bangs, Bull. Mus. Comp. Zoöl., **36**, 1901, p. 258.

Type.— No. 37,298, ♀; Loo-Choo Islands, Yaeyama; 10 June, 1899; I. Zensaku.

Sterna pileata Scopoli, Del. Flor. at Faun. Insubr., **2**, 1786, p. 92.

The noddy of the Loo-Choo Islands is slightly different from that of the Philippines, and some day *A. pullus* may have to be recognized.

Larus thayeri W. S. Brooks

now Larus argentatus thayeri Brooks

Larus thayeri W. S. Brooks, Bull. Mus. Comp. Zoöl., **59**, 1915, p. 373.

Type.— No. 40,336, ♂; Ellesmere Land, Buchanan Bay; 10 June, 1901; J. S. Warmbath.

HAEMATOPODIDAE

Haematopus prattii Maynard

now Haematopus palliatus prattii Maynard

Haematopus prattii Maynard, App. to Cat. West Ind. Birds, 1899, p. 34.

Cotypes.— No. 103,360, ♂; Bahamas; Flemmings Key; 29 April, 1895; C. J. Maynard.

Cotype.— No. 103,361, ♀; Bahamas, Flemmings Key; 29 April, 1895; C. J. Maynard.

Haematopus frazari Brewster

now Haematopus palliatus frazari Brewster

Haematopus frazari Brewster, Auk, **5**, 1888, p. 84.

Type.— No. 214,135, ♂; Lower California, Carmen Island; 6 March, 1887; M. A. Frazar.

CHARADRIIDAE

Stephanibyx coronatus demissus Friedmann

Stephanibyx coronatus demissus Friedmann, Proc. New. Eng. Zoöl. Club, **10**, 1928, p. 97.

Type.— No. 234,891, ♂; British Somaliland, Suk-soda; 22 February, 1899; Lort Phillips.

Squatarola squatarola cynosurae Thayer and Bangs

Squatarola squatarola cynosurae Thayer and Bangs, Proc. New Eng. Zoöl. Club, **5**, 1914, p. 23.

Type.— No. 102,657, ♂; Arctic America, Baillie Island, Mackenzie; 13 July, 1901; H. H. Bodfish.

Much difference of opinion has been expressed, whether or not to recognize the American gray plover by name. Breeding birds from the interior of arctic America, as also most of the migrants from eastern North America, are small. The European bird, *S. squatarola squatarola* (Linné), is next in point of size, and the east Siberian *S. s. hypomelaena* (Pallas) is the largest. It seems to me we must either keep all three races, or unite all under one name. I am still inclined to retain all three, although admitting that they are close, and not always to be told apart from migrant birds alone.

If this is done, then in addition to *S. s. cynosurae*, *S. s. hypomelaena* also must be listed as an American bird. Breeding birds from Alaska have the extreme proportions of the East Siberian form. In Mr. A. C. Bent's collection there is a pair of birds, parents to a set of eggs taken at Eviksuk (near Point Barrow), Alaska, June 15 and 18, 1917, the male with a wing of 196, the female with a wing of 200.

Charadrius wilsonia Ord.

now Charadrius wilsonia wilsonia Ord.

Charadrius wilsonia Ord, Wils., Am. Orn., **9**, 1814, p. 77, pl. 3, fig. 5

Cotype.— No. 67,839 [♂]; New Jersey; Cape Island; 13 May, 1813; A. Wilson.

Cotype.— No. 67,840 [♀]; New Jersey; Cape Island; 13 May, 1813; A. Wilson.

From the old Peale Museum.

Charadrius semipalmatus Bonaparte

Charadrius semipalmatus Bonaparte, Jour. Acad. Nat. Sci., Phila., **5**, 1825, p. 98.

Type.— No. 67,837; New Jersey; from the old Peale Museum.

SCOLOPACIDAE

Symphemia semipalmata inornata Brewster

now Catoptrophorus semipalmatus inornatus (Brewster)

Symphemia semipalmata inornata Brewster, Auk, **4**, 1887, p. 145

Cotype.— No. 213,529, ♂; Colorado, Larimer Co.; 14 May, 1886; H. G. Smith.

Cotype.— No. 213,530, ♀; Colorado, Larimer Co.; 5 May, 1885; H. G. Smith.

Totanus solitarius cinnamomeus Brewster

now Tringa solitarius cinnamomeus (Brewster)

Totanus solitarius cinnamomeus Brewster, Auk, **7**, 1890, p. 377.

Type.— No. 217,735, ♂; Lower California, San José del Cabo; 30 August, 1887; M. A. Frazar.

† Totanus melanoleucus frazari Brewster

= Tringa melanoleucus (Gmelin)

Totanus melanoleucus frazari Brewster, Bull. Mus. Comp. Zoöl., **41**, 1902, p. 65.

Type.— No. 217,815, ♂; Lower California, San José del Cabo; 27 September, 1887; M. A. Frazar.

Scolopax melanoleuca Gmelin, Syst. Nat., 1, pt. 2, 1789, p. 659.

† Totanus polynesiae Peale

= Heteroscelus incanus (Gmelin)

Totanus polynesiae Peale, U. S. Expl. Exped., **8**, 1848, p. 237.

Cotype.— No. 75,668; Polynesia; T. R. Peale.

Scolopax incanus Gmelin, Syst. Nat., 1, pt. 2, 1789, p. 658.

Peale collected other examples than the cotype listed above, which found its way into our museum. Some of these may still be in existence.

Tringa parvirostris Peale

now Aechmorhynchus parvirostris (Peale)

Tringa parvirostris Peale, U. S. Expl. Exped., **8**, 1848, p. 235.

Cotype.— No. 72,156; Paumotu Islands; T. R. Peale.

Other cotypes than ours may exist.

† Limicola hartlaubi Verreaux

= Limicola falcinellus falcinellus (Pontoppidan)

Limicola Hartlaubi Verreaux, Vinson's Voy. Madagascar, annexe. B., 1865, p. 5.

Type.— No. 74,868; Madagascar (Lafresnaye Coll., no. 7,570).

Scolopax Falcinellus Pontoppidan, Dansk. Atlas, **1**, 1763, p. 623.

GLAREOLIDAE

† Cursorius cursor meruensis Mearns

= Cursorius cursor littoralis Erlanger

Cursorius cursor meruensis Mearns, Smith. Misc. Coll., **65**, 1915, p. 5.

Type.— No. 56,130, ♀; British East Africa; Miru River; 10 August, 1909; G. M. Allen.

Cursorius cursor littoralis Erlanger, Jour. Ornith., 1905, p. 58.

Rhinoptilus africanus illustris Friedmann

Rhinoptilus africanus illustris Friedmann, Proc. New Eng. Zoöl. Club, **10**, 1928, p. 80.

Type.— No. 133,332, ♂; Tanganyika Territory, Kididimo, Dodoma; 12 April, 1922; A. Loveridge.

GRUIDAE

Megalornis canadensis tabida Peters

now Grus canadensis tabida (Peters)

Megalornis canadensis tabida Peters, Auk, **42**, 1925, p. 122.

Type.— No. 72,695, ♂; Nevada, Southfork Valley, HumboldtRiver; 19 May, 1859; C. S. McCarthy.

Grus nesiotes Bangs and Zappey

now Grus canadensis nesiotes Bangs and Zappey

Grus nesiotes Bangs and Zappey, Am. Nat., **39**, 1905, p. 193.

Type.— No. 113,238, ♂; Isle of Pines near Cuba, La Vega; 8 May, 1904; W. R. Zappey.

ARAMIDAE

Aramus pictus elucus Peters

Aramus pictus elucus Peters, Occ. Papers Bost. Soc. N. H., **5**, 1925, p. 143.

Type.— No. 70,021, ♀; Santo Domingo, Sousa; 22 March, 1916; J. L. Peters.

Aramus pictus dolosus Peters

Aramus pictus dolosus Peters, Occ. Papers Bost. Soc. N. H., **5**, 1925, p. 144.

Type.— No. 54,162, ♂; Costa Rica, Bolsón; 25 December, 1907; C. F. Underwood.

PLEGADIDAE

† Ibis lamellicollis Lafresnaye

= Carphibis spinicollis (Jameson)

Ibis lamellicollis Lafresnaye, Mag. Zoöl., 1836, pl. 57, text.

Type.— No. 84,291 (Lafresnaye Coll., no. 7,797); Nouvelle Hollande: "Lieut. Col. Despard commanding 17th Regt. Parramatta."

Ibis spinicollis Jameson, Edinb. New Philos. Jour., **19**, 1835, p. 213.

† Ibis ordi Bonaparte

= Plegadis falcinellus falcinellus (Linné)

Ibis ordi Bonaparte, Geog. and Compar. List, 1838, p. 49.

Type.— No. 248,861. From the old Peale Museum.

Tantalus Falcinellus Linné, Syst. Nat., **12**, 1, 1766, p. 241.

This specimen is the one figured by Bonaparte in his American Ornithology as *Ibis falcinellus*, and afterward named *ordi*.

Falcinellus ridgwayi Allen

now Plegadis ridgwayi (Allen)

Falcinellus ridgwayi J. A. Allen, Bull. Mus. Comp. Zoöl., **3**, 1876, p. 355.

Cotype.— No. 24,336; Peru, Lake Titicaca, Conima; 28 January, 1875.

Cotype.— No. 24,339; Peru, Lake Titicaca, Conima; 26 January, 1875.

Cotype.— No. 24,340; Peru, Lake Titicaca, Conima; 26 January, 1875.

Cotype.— No. 24,347; Peru, Lake Titicaca, Conima; 26 January, 1875.

Cotype.— No. 24,335; Peru, Lake Titicaca, Vilque Chico; 23 January, 1875.

Cotype.— No. 24,342; Peru, Lake Titicaca, Vilque Chico; 23 January, 1875.

Cotype.— No. 23,343; Peru, Lake Titicaca, Vilque Chico; 23 January, 1875.

Cotype.— No. 24,344; Peru, Lake Titicaca, Vilque Chico; 23 January, 1875.

Cotype.— No. 24,345; Peru, Lake Titicaca, Vilque Chico; 23 January, 1875.

Cotype.— No. 24,341; Peru, Lake Titicaca, Moho; 26 January, 1875. All collected by S. Garman.

This form, which it seems to me, is entitled to specific rank, was described by Dr. Allen from thirteen specimens all of which must be regarded as cotypes, no holotype having been designated. Three of these birds are no longer in the museum and no record was kept of what was done with them. I think, however, that they were exchanged with other museums or private collectors.

ARDEIDAE

Ardea herodias cognata Bangs

Ardea herodias cognata Bangs, Proc. New Eng. Zoöl. Club, **3**, 1903, p. 99.

Type.— No. 112,451; Galapagos Islands, Indefatigable Island; 16 February, 1901; R. H. Beck.

Ardea herodias sancti-lucae Thayer & Bangs

Ardea herodias sancti-lucae Thayer and Bangs, Proc. New Eng. Zoöl. Club, **4**, 1912, p. 83.

Type.— No. 18,303, collection of John E. Thayer, deposited in the Museum of Comparative Zoölogy, ♂; Lower California, Espiritu Santo Island; 13 June, 1910; W. W. Brown.

Ardea repens Bangs and Zappey

now Ardea herodias repens Bangs and Zappey

Ardea repens Bangs and Zappey, Am. Nat., **39**, 1905, p. 186.

Type.— No. 113,241, ♀ ; Isle of Pines, near Cuba, Cienega; 24 May, 1904; W. R. Zappey.

The type is a bird in the white phase of plumage.

Egretta candidissima brewsteri Thayer and Bangs

now Egretta thula brewsteri Thayer and Bangs

Egretta candidissima brewsteri Thayer and Bangs, Proc. New Eng. Zoöl. Club, **4**, 1909, p. 40.

Type.— No. 11,419, collection of John E. Thayer, deposited in the Museum of Comparative Zoölogy, ♂; Lower California, San José Island (near La Paz); 20 June, 1908; W. W. Brown.

Butorides striatus patens Griscom

Butorides striatus patens Griscom, Bull. Mus. Comp. Zoöl., **69**, 1929, p. 156.

Type.— No. 114,030, ♀ ; Panama, near Panama City; 26 May, 1904; W. W. Brown.

Butorides albidulus Bangs

now Butorides striatus albidulus (Bangs)

Butorides albidulus Bangs, Proc. Biol. Soc. Washington, **26**, 1913, p. 93.

Type.— No. 39,356, ♀ ; Maldive Islands, Luadiva Atoll; 2 January, 1902; H. B. Bigelow.

Ardea virescens frazari Brewster

now Butorides virescens frazari (Brewster)

Ardea virescens frazari Brewster, Auk, **5**, 1888, p. 83.

Type.— No. 213,134, ♂; Lower California, La Paz; 7 February, 1887; M. A. Frazar.

† Butorides virescens dominicanus Oberholser

= Butorides virescens maculatus (Boddaert)

Butorides virescens dominicanus Oberholser, Proc. U. S. Nat. Mus., **42**, 1912, p. 562.

Type.— No. 113,629, ♂; Dominica, Roseau; 30 June, 1905; A. H. Verrill.

Cancroma maculata Boddaert, Tabl. Pl. Enl., 1783, p. 54.

† Butorides virescens barbadensis Oberholser

= Butorides virescens maculatus (Boddaert)

Butorides virescens barbadensis Oberholser, Proc. U. S. Nat. Mus., **42**, 1912, p. 567.

Type.— No. 112,629, ♂; Barbados; 11 September, 1903; Austin H. Clark.

Cancroma maculata Boddaert, Tabl. Pl. Enl., 1783, p. 54.

† Butorides virescens tobagensis Oberholser

= Butorides virescens maculatus (Boddaert)

Butorides virescens tobagensis Oberholser, Proc. U. S. Nat. Mus., **42**, 1912, p. 571.

Type.— No. 18,033; Tobago Island; R. W. Rawson.

Cancroma maculata Boddaert, Tabl. Pl. Enl., 1783, p. 54.

ANATIDAE

Chen atlantica Kennard

Chen atlantica Kennard, Proc. New Eng. Zoöl. Club, **9**, 1927, p. 93.

Type.— No. 6, ♂; Kennard Collection (in Mus. Comp. Zoöl.); Virginia, Back Bay, Princess Anne County; 2–9 December, 1922.

I agree wholly with Kennard that the Greater Snow Goose is a distinct species.

Chloephaga hybrida malvinarum Phillips

Chloephaga hybrida malvinarum Phillips, Auk, **33**, 1916, p. 423.

Type.— No. 70,476, ♂; West Falkland, Port Stephens; 13 December, 1915; W. S. Brooks.

† Anas kasarkoides Lafresnaye

= Casarca tadornoides (Jardine and Selby)

Anas kasarkoides Lafresnaye, Mag. Zoöl., 1835, Classe ii, pl. 36 and text.

Type.— No. 84,641 (Lafresnaye Coll., no. 8,228); "Nouvelle Hollande."

Anas tadornoides Jardine and Selby, Illus. Ornith., **2**, pl. 62, 1828.

Anas obscurus rubripes Brewster

now Anas rubripes rubripes Brewster

Anas obscurus rubripes Brewster, Auk, **19**, 1902, p. 183.

Type.— No. 230,252, ♂; Maine, Lake Umbagog; 8 October, 1889; W. Brewster.

For *Anas rubripes tristis* Brewster (Auk, **26**, 1909, p. 176), no type, of course, was designated as it is only a new name for *Anas obscurus* Gmelin *nec* Pontoppidan.

Querquedula discors albinucha Kennard

Querquedula discors albinucha Kennard, Auk, **36**, 1919, p. 459.

Type.— (Not numbered), ♂; (Kennard Coll. in Mus. Comp. Zoöl.); Louisiana, Grand Chenier, Cameron Parish; 2 April, 1916.

This form has been questioned; breeding males, however, from the southern part of the range of the species usually if not always show the peculiar white marking of the head, and northern breeding males usually do not. I, therefore, let the question rest as Kennard had it, for the present at least.

Histrionicus histrionicus pacificus W. S. Brooks

Histrionicus histrionicus pacificus W. S. Brooks, Bull. Mus. Comp. Zoöl., **59**, 1915, p. 393.

Type.— No. 66,786, ♂; Kamchatka, Cape Shipunski; 22 May, 1913; J. Dixon.

Oidemia deglandi dixoni W. S. Brooks

Oidemia deglandi dixoni W. S. Brooks, Bull. Mus. Comp. Zoöl., **59**, 1915, p. 393.

Type.— No. 66,787, ♂; Alaska, Griffin Point; 13 June, 1914; J. Dixon.

This form has been a good deal discussed, some authors upholding it, other considering it inseparable from true *deglandi*. All specimens (seven in number) that I have examined I can tell from true *deglandi*, so for the present, at least, I allow it to stand.

Anas rubidus Wilson

now Oxyura jamaicensis rubidus (Wilson)

Anas rubidus Wilson, Am. Orn., **8**, 1814, p. 128, pl. 71, fig. 5.

Type.— No. 67,821, from the old Peale Museum, the specimen figured by Wilson.

Wetmore (Birds of Porto Rico and the Virgin Islands, N. Y. Acad. Sci., **9**, 1927, p. 314) keeps the North American Ruddy Duck distinct from the West Indian on account of the slightly larger size of the former.

PHALACROCORACIDAE

Phalacrocorax africanus pictilis Bangs

Phalacrocorax africanus pictilis Bangs, Bull. Mus. Comp. Zoöl., **59**, 1918, p. 500.

Type.— No. 77,555, ♂; Madagascar, Miandrivazo; 26 June, 1915; F. R. Wulsin.

ANHINGIDAE

Anhinga vulsini Bangs

now Anhinga rufa vulsini Bangs

Anhinga vulsini Bangs, Bull. Mus. Comp. Zoöl., **59**, 1918, p. 501.

Type.— No. 77,550, ♂; Madagascar, Maevetanana; 20 June, 1915; F. R. Wulsin.

SULIDAE

† Sula elegans Bryant

= Sula dactylatra dactylatra Lesson

Sula elegans Bryant, Proc. Bost. Soc. N. H., **7**, 1859, p. 125.

Cotype.— No. 42,939, ♂
Cotype.— No. 42,940, ♀
Cotype.— No. 42,941, ♀
} Bahamas, San Domingo Key; 10 April

All taken by Bryant.

Sula dactylatra Lesson, Traité, 1831, p. 601.

Sula coryi Maynard

= Sula sula sula (Linné)

Sula coryi Maynard, Contr. Sci., **1**, 1899, pp. 40–48; 51–57.

Cotype.— No. 244,947, ♂; Little Cayman Island; 4 May, 1888; C. J. Maynard.

Cotype.— No. 244,948, ♀; Little Cayman Island; 2 May, 1888; C. J. Maynard.

Cotype.— No. 244,949; Little Cayman Island; 2 May, 1888; C. J. Maynard.

Cotype.— No. 244,950, ♂; Little Cayman Island; 2 May, 1888; C. J. Maynard.

Pelecanus sula Linné, Syst. Nat., 1766, p. 218.

Sula etesiaca Thayer and Bangs

now Sula (leucogastra ?) etesiaca Thayer and Bangs

Sula etesiaca Thayer and Bangs, Bull. Mus. Comp. Zoöl., **46**, 1905, p. 92.

Type.— No. 114,026, ♂; Gorgona Island (off west coast of Colombia); 29 June, 1904. W. W. Brown.

FALCONIDAE

Ibycter americanus guatemalensis Swann

Ibycter americanus guatemalensis Swann, Syn. List. Accip., ed. 2, 1921, p. 14.

Type.— No. 92,678, ♀; Guatemala; Swann Collection.

Milvago chimachima cordatus Bangs and Penard

Milvago chimachima cordatus Bangs and Penard, Bull. Mus. Comp. Zoöl., **62**, 1918, p. 35.

Type.— No. 40,373, ♀; San Miguel Island, Pearl Islands, Bay of Panama; 27 February, 1904; W. W. Brown.

milvago chimachima paludivaga Penard

Milvago chimachima paludivaga Penard, Proc. New Eng. Zoöl. Club, **8**, 1923, p. 36.

Type.— No. 89,376, ♂; Surinam, Paramaribo; 2 September, 1921. T. E. Penard.

† Circus cyaneus cernuus Thayer and Bangs

= Circus cyaneus taissiae Buturlin

Circus cyaneus cernuus Thayer and Bangs, Proc. New Eng. Zoöl. Club, **4**, 9 April, 1914.

Type.— No. 64,026, ♂; Siberia, Nischnij, Kolyma; 4 June, 1912; J. Koren.

Circus taissiæ Buturlin, J. f. O., 1908, p. 283.

Hartert has questioned the validity of this form, saying that birds with light gray breasts also occur in Europe. The breast, however, is not so strong a character in the race, as the very pale silvery color of the whole upper parts. This I have never seen even approached in the large number of skins I have examined from Europe, India and China.

Thayer and I overlooked Buturlin's name, principally I suppose, because it did not appear in the Zoölogical Record. Descriptions tucked away in footnotes are apt to be overlooked.

The type locality of the form, which seems to me good, is I fancy, Kolyma, although not definitely so stated by Buturlin, who simply says that the bird was presented by Fraülein Taissia Michailovna Akimova, Ärztin in Kolyma.

† Falco percontator Cabot

= Micrastur melanoleucus naso (Lesson)

Falco percontator Cabot, Jour. Bost. Soc. N. H., **4**, 1844, p. 462.

Cotype.— No. 72,572, ♂
Cotype.— No. 72,573, ♀
} Yucatan, Chichen Itza; S. Cabot

Carnifex naso Lesson, Rev. Zoöl., 1842, p. 379.

Micrastur interstes Bangs

now Micrastur guerilla interstes Bangs

Micrastur interstes Bangs, Auk, **24**, 1907, p. 289.

Type.— No. 116,414, ♂; Costa Rica, La Estrella, Cartago; 28 March, 1903; C. F. Underwood.

My own feeling is against subdividing the genus *Micrastur*, and I, therefore, do not recognize *Clamosocircus*.

Geranospiza caerulescens livens Bangs and Penard

Geranospiza caerulescens livens Bangs and Penard, Proc. Biol. Soc. Washington, **34**, 1921, p. 89.

Type.— No. 224,793, ♀ ; Sonora, Alamos; 9 February, 1888; M. A. Frazar.

Urotriorchis macrourus batesi Swann

Urotriorchis macrourus batesi Swann, Syn. List. Acc., ed. 2, 1921, p. 29.

Type.— No. 92,639, ♀ ; Cameroons, River Ja, Bityza; 17 April, 1914; G. L. Bates.

Melierax metabates ignoscens Friedmann

Melierax metabates ignoscens Friedmann, Proc. Biol. Soc. Washington, **41**, 29 June, 1928, p. 94.

Type.— No. 92,650, ♂; Arabia, Aden; 19 January, 1922; Col. R. Meinertzhagen.

Astur rufitorques Peale

now Astur fasciatus rufitorques Peale

Astur rufitorques Peale, U. S. Expl. Exped., 1848, p. 68.

Cotype.— No. 75,679, ♂ adult; Fiji Islands; T. R. Peale.

Accipiter superciliosus exitiosus Bangs and Penard

Accipiter superciliosus exitiosus Bangs and Penard, Proc. New Eng. Zoöl. Club, **7**, 1920, p. 45.

Type.— No. 120,776, ♀ adult; Costa Rica, Carillo; 13 May, 1907; C. F. Underwood.

Todd (Bds. Santa Marta, pp. 147–148) suggests that this name of Bangs and Penard may prove to be antedated by *Accipiter fontanieri* Bonaparte (Rev. et Mag. Zoöl., **5**, 1853, p. 578) based on an immature bird. Lately Hellmayr (A contr. to the Orn. of N. E. Brazil, Field Mus. of N. H., **12**, 1929, p. 459) who has examined the type in the Paris Museum, which he says was obtained by Fontanier at Santa Cruz, in the Santa Marta region, declares that *fontanieri* must replace *exitiosus*. I do not feel sure of this. I have never been able to distinguish the two races in immature plumage. The only two Santa Marta specimens I know of are immature, the type of *fontanieri* and the one in the Carnegie Museum, which I have examined.

The range of *exitiosus* certainly extends to western Colombia, as shown by adult specimens from Barbacoas and the Cauca River. Whether the Santa Marta bird will prove to be *exitiosus* still remains to be seen. Many Central American forms extend into western Colombia and even to western Ecuador, and in the east stop short of the Santa Marta region. I, therefore, allow *exitiosus* to stand, until adult specimens show just what the Santa Marta form is.

Accipiter chionogaster venezuelensis Swann

Accipiter chionogaster venezuelensis Swann, Syn. List Accip., ed. 2, 1921, p. 58.

Type.— No. 92,476 [♀]; Venezuela; Merida region, Escorial; 17 February, 1911; Briceño Gabaldon y hijos.

Accipiter bicolor fidens Bangs and Noble

Accipiter bicolor fidens Bangs and Noble, Auk, **35**, 1918, p. 444.

Type.— No. 102,289, ♀; Mexico, Vera Cruz, Buena Vista; 14 June, 1901; Colburn and Shufeldt.

Heterospizias meridionalis australis Swann

Heterospizias meridionalis australis Swann, Auk, **38**, 1921, p. 359.

Type.— No. 92,425, ♂; Argentina, Tucuman, Laguna de Malimas; 31 March, 1902; L. Dinelli.

If the range of this form is found to extend into Paraguay, Swann's name will then become a synonym of *Circus rufulus* Vieillot (Nouv. Dict. Hist. Nat., **4**, 1816, p. 466).

Geranoaetus melanoleucus meridensis Swann.

Geranoaetus melanoleucus meridensis Swann, Syn. List Acc., ed. 2, 1922, p. 68.

Type.— No. 92,697, ♂; Venezuela, Merida region, Nevada; 20 October, 1911; Briceño Gabaldon y hijos.

Buteo borealis umbrinus Bangs

now Buteo jamaicensis umbrinus Bangs

Buteo borealis umbrinus Bangs, Proc. New Eng. Zoöl. Club, **2**, 1901, p. 68.

Type.— No. 103,314, ♀; Florida, Manatee Co., Micco; April, 1888; O. Tollen.

Mr. James L. Peters has pointed out to me that *Falco jamaicensis* Gmelin, 1788, p. 266, appears on the same page but earlier than *Falco borealis*, and that, therefore, all the American red-tailed hawks must be listed as races of *jamaicensis*.

Buteo lineatus extimus Bangs

Buteo lineatus extimus Bangs, Proc. New Eng. Zoöl. Club, **7**, 1920, p. 35.

Type.— No. 6,899, ♂; Florida, Cape Florida; 5 April, 1858; G. Wurdemann.

Buteo antillarum Clark

now Buteo platypterus antillarum Clark

Buteo antillarum Clark, Proc. Biol. Soc. Washington, **18**, 1905, p. 62.

Type.— No. 112,852, ♂; Lesser Antilles, St. Vincent, Chateau Belair; 24 September, 1903; Austin H. Clark.

Asturina nitida costaricensis Swann

Asturina nitida costaricensis Swann, Syn. List Accip., ed. 2, 1922, p. 90.

Type.— No. 117,983, ♂; Costa Rica, Boruca, Pozo del Rio Grande; 5 April, 1906; C. F. Underwood.

Rupornis magnirostris ecuadoriensis Swann

Rupornis magnirostris ecuadoriensis Swann, Syn. List Accip., ed. 2, 3 January, 1922, p. 91.

Type.— No. 92,412, ♀; Ecuador (northern), Vaquero; 20 September, 1901; Swann Collection.

Chapman (Distribution of Bird-life in Ecuador) is rather inclined to place this form in the synonymy of true *maguirostris*. It appears to me to represent a race, which though not strongly characterized, still is sufficiently different from *R. m. maguirostris* to deserve a name.

Rupornis magnirostris insidiatrix Bangs and Penard

Rupornis magnirostris insidiatrix Bangs and Penard, Bull. Mus. Comp. Zoöl., **52**, 1918, p. 36.

Type.— No. 105,014, ♀; Colombia, Santa Marta Mountains; 16 January, 1898; W. W. Brown.

Rupornis magnirostris occidua Bangs

Rupornis magnirostris occidua Bangs, Proc. Biol. Soc. Washington, **24**, 1911, p. 187.

Type.— No. 47,362, sex ?; Peru (eastern), Rio Tambopata; May, 1907; W. C. Farrabee.

Rupornis magnirostris griseocauda Ridgway

Rupornis magnirostris var. *griseocauda* Ridgway, Proc. Bost. Soc. N. H., **16**, 1873–74, p. 87 in key, 88 in text.

Cotype.— No. 77,366, ♂; Mexico, Rio Seco; January, 1866; F. Sumichrast.

Cotype.— No. 77,367, sex ?; Mexico, Tehuantepec (without date); F. Sumichrast.

Rupornis magnirostris conspecta Peters

Rupornis magnirostris conspecta Peters, Auk, **30**, 1913, p. 370.

Type.— No. 40,123, ♂; Yucatan, San Ignacio; 9 February, 1904; L. J .Cole.

Rupornis magnirostris arguta Peters and Griscom

Rupornis magnirostris arguta Peters and Griscom, Proc. New Eng. Zoöl. Club, **11**, 1929, p. 46.

Type.— No. 234,242, ♂; Panama, Almirante; 26 February, 1926; J. D. Smith.

Rupornis magnirostris alia Peters and Griscom

Rupornis magnirostris alia Peters and Griscom, Proc. New Eng. Zoöl. Club, **11**, 1929, p. 48.

Type.— No. 114,285, ♀; El Rey Island, San Miguel, Pearl Islands, Bay of Panama; 24 February, 1904; W. W. Brown.

† Busarellus nigricollis macropus Swann

= Busarellus nigricollis nigricollis (Latham)

Busarellus nigricollis macropus Swann, Syn. List Acc., ed. 2, 1922, p. 95.

Type.— No. 115,838, ♂; British Honduras, Manatee River; 12 May, 1906; G. B. Thomas.

Falco nigricollis Latham, Ind. Orn., **1**, 1790, p. 35 (Cayenne).

I am wholly unable to distinguish a northern form.

† Urubitinga urubitinga occidentalis Swann

= Urubitinga urubitinga urubitinga (Gmelin)

Urubitinga urubitinga occidentalis Swann, Syn. List Accip., ed. 2, 1922, p. 97.

Type.— No. 111,045, ♀; Ecuador, Rio Bogata; 15 February, 1901.

Falco urubitinga Gmelin, Syst. Nat., **1**, 1788, p. 265 (Brazil).

The type has the longer primaries in both wings shot off, hence Swann's short measurement for the wing. Peters and I, after careful comparison of skins, can find no way to separate the Ecuadorian bird from true *urubitinga*.

Urubitinga anthracina cancrivora Clark

Urubitinga anthracina cancrivora Clark, Proc. Biol. Soc. Washington, **18**, 1905, p. 63.

Type.— No. 115,804, ♀; Lesser Antilles, St. Vincent; 22 January, 1905; Austin H. Clark.

This is a poorly characterized form which eventually may go into the synonymy of true *anthracina*.

† Urubitinga anthracina bangsi Swann

= Urubitinga anthracina anthracina (Lichtenstein)

Urubitinga anthracina bangsi Swann, Syn. List Accip., ed. 2, 1922, p. 98.

Type.— No. 114,287, ♂; San Miguel Island, Pearl Islands, Bay of Panama; 20 March, 1904; W. W. Brown.

Falco anthracinus Lichtenstein, Preiz. Verz. Mex. Vög., 1830, p. 3 (Mexico).

The two skins upon which Swann based *bangsi*, are, so far as I can see, in no way different from Mexican and Central American specimens.

Urubitinga subtilis Thayer and Bangs

Urubitinga subtilis Thayer and Bangs, Bull. Mus. Comp. Zoöl., **46**, 1905, p. 94.

Type.— No. 114,001, ♂; Gorgona Island, off western Colombia; 1 July, 1904; W. W. Brown.

This bird, which in the adult plumage looks much like a miniature *anthracina*, is apparently in reality a distinct species. It occurs in the same region with *anthracina*, but fills a different niche.

Mr. A. J. van Rossem tells me that in Salvador both species occur,

but that *subtilis* is wholly confined to the mangroves of the coast. Mr. Ludlow Griscom had the same experience on the Pacific side of Panama. In this habit *subtilis* is like *U. gundlachi* of Cuba, which does not occur away from the mangrove fringed coasts. The range of *subtilis* is now known to extend along the Pacific coast of the Americas from western Ecuador to San Salvador.

Herpetotheres cachinnans chapmani Bangs and Penard

Herpetotheres cachinnans chapmani Bangs and Penard, Bull. Mus. Comp. Zoöl., **62**, 1918, p. 37.

Type.— No. 60,743, ♂; Mexico, Quintana Roo, Santa Lucia; 22 January, 1912; J. L. Peters.

Herpetotheres cachinnans queribundus Bangs and Penard

Herpetotheres cachinnans queribundus Bangs and Penard, Bull. Mus. Comp. Zoöl., **63**, 1919, p. 23.

Type.— No. 7,792, sex ?; Brazil, Pernambuco; J. C. Fletcher.

Herpetotheres cachinnans maestus Bangs and Noble

Herpetotheres cachinnans maestus Bangs and Noble, Auk, **35**, 1918, p. 444.

Type.— No. 80,152, ♀; Peru, Bellavista; 29 September, 1916; G. K. Noble.

Spilornis cheela burmanicus Swann

Spilornis cheela burmanicus Swann, Syn. List Accip., 1920, p. 21.

Type.— No. 92,594, ♀; Burma, Thayetmyo, Jobin; 5 March, 1905; Swann Collection.

Spilornis cheela malayensis Swann

Spilornis cheela malayensis Swann, Syn. List Accip., 1920, p. 83.

Type.— No. 92,595, ♀; Pahang, Raub; 28 June, 1903; W. H. Craddock.

Elanus leucurus majusculus Bangs and Penard

Elanus leucurus majusculus Bangs and Penard, Proc. New Eng. Zoöl. Club, **7**, 1920, p. 46.

Type.— No. 100,915, ♂; California, San Rafael; 1 December, 1883; C. A. Allen.

Gampsonyx swainsoni meridensis Swann

Gampsonyx swainsoni meridensis Swann, Syn. List Accip., 1920, p. 104.

Type.— No. 92,597, ♂; Venezuela, Merida region, Nevada; 15 November, 1903; Briceño Gabaldon y hijos.

Aviceda verreauxi Lafresnaye

now Aviceda cuculoides verreauxi Lafresnaye

Aviceda verreauxi Lafresnaye, Rev. Zoöl., 1846, p. 130.

Type.— No. 76,192; Natal; Lafresnaye Collection, no. 395.

† Aviceda sumatrensis Lafresnaye

= Aviceda jerdoni jerdoni (Blyth)

Aviceda sumatrensis Lafresnaye, Rev. Zoöl., 1848, p. 210 (Sumatra).

Type.— No. 83,772; Lafresnaye Collection, no. 394.

Lophaster jerdoni Blyth, Journ. As. Soc. Bengal, **11**, pt. 1, 1842 (Malacca).

Falco anatum Bonaparte

now Falco peregrinus anatum Bonaparte

Falco anatum Bonaparte, Comp. and Geog. List, 1838, p. 4.

Type.— No. 67,848, sex ?; New Jersey, Great Egg Harbour; December, 1812; A. Wilson. From the old Peale Museum.

Bonaparte's first reference is to *Falco peregrinus* of Wilson, and as the bird listed above is the one figured by Wilson, it is of course the type.

Falco columbarius bendirei Swann

Falco columbarius bendirei Swann, Bull. B. O. C., **42**, 1922, p. 66.

Type.— No. 207,687, ♂; Washington, Walla Walla; 18 October, 1881; Capt. C. E. Bendire.

Falco aesalon lymani Bangs

now Falco columbarius lymani Bangs

Falco aesalon lymani Bangs, Bull. Mus. Comp. Zoöl., **54**, 1912, p. 465.

Cotype.— No. 57,672,♂ } a mated pair, Altai Mountains, Tehegan-
Cotype.— No. 57,673, ♀ } Burgazi Pass; 10 July, 1912; N. Hollister.

† Cerchneis sparverius guatemalensis Swann

= Falco sparverius sparverius Linné

Cerchneis sparverius guatemalensis Swann, Syn. List Accip., 1920, p. 156.

Cotype.— No. 92,772 [♂]; Guatemala, Capetillo; J. J. Rodriguez.

Falco sparverius Linné, Syst. Nat., 1758, p. 90 (Carolina).

Swann, when he described this bird, made two cotypes, the other is in the British Museum, and I have been unable, of course, to see it in this connection. The cotype listed above, is without any question, an example of the common North American sparrow hawk taken on migration. Peters and I have compared it carefully.

Cerchneis sparverius paulus Howe and King

now Falco sparverius paulus (Howe and King)

Cerchneis sparverius paulus Howe and King, Contrib. N. A. Orn., **1**, May 21, 1902, p. 28.

Type.— No. 49,999, ♂; Florida, Miami; 20 March, 1902.

BUBONIDAE

Otus abyssinicus Guérin

now Asio abyssinicus abyssinicus (Guérin)

Otus abyssinicus Guérin, Rev. Zoöl., 1843, p. 321 (Abyssinia).

Type.— No. 74,865; (Lafresnaye Coll., no. 755); Abyssinia.

Bubo bubo jarlandi La Touche

Bubo bubo jarlandi LaTouche, Bull. B. O. C., **42**, 1921, p. 14.

Type.— No. 131,209, ♀; Yunnan, Mengtsz; caught alive, spring of 1921, died in confinement, June, 1921; La Touche Collection.

Bubo virginianus elachistus Brewster

Bubo virginianus elachistus Brewster, Bull. Mus. Comp. Zoöl., **41**, no. 1, 1902, p. 96.

Type.— No. 217,866, ♂; Lower California, Sierra de la Laguna; 29 April, 1887; M. A. Frazar.

Asio magellanicus heterocnemis Oberholser

now Bubo virginianus heterocnemis (Oberholser)

Asio magellanicus heterocnemis Oberholser, Proc. U. S. Nat. Mus., **27**, 1904, p. 187.

Type.— No. 104,445, ♂; Labrador, Lance au Loup; 9 April, 1899; Ernest Doane.

Bubo cinerascens Guérin

now Bubo africanus cinerascens (Guérin)

Bubo cinerascens Guérin, Rev. Zoöl., 1843, p. 321 (Abyssinia).

Type.— No. 74,866; (Lafresnaye Coll., no. 754); Abyssinia.

Pulsatrix perspicillata trinitatis Bangs and Penard

Pulsatrix perspicillata trinitatis Bangs and Penard, Bull. Mus. Comp. Zoöl., **62**, 1918, p. 51.

Type.— No. 29,469, sex ?; Trinidad; C. S. Cazabon.

Megascops asio aikeni Brewster

now Otus asio aikeni (Brewster)

Megascops asio aikeni Brewster, Auk, **8**, April, 1891, p. 139. (Separates were published in advance — February 17, 1891).

Type.— No. 207,503; Colorado, El Paso Co.; 29 May, 1872.

Megascops asio macfarlanei Brewster

now Otus asio macfarlanei (Brewster)

Megascops asio macfarlanei Brewster, Auk, **8**, April, 1891, p. 140. (Separates were published in advance — February 17, 1891.)

Cotype.— No. 206,456, ♀; Washington, Fort Walla Walla; 19 February, 1881; Capt. C. E. Bendire.

Cotype.— No. 206,457, ♂; Washington, Fort Walla Walla; 20 November, 1881; Capt. C. E. Bendire.

† Megascops asio saturatus Brewster

= Otus asio kennicottii (Elliott)

Megascops asio saturatus Brewster, Auk, **8**, April, 1891, p. 141. (Separates were published in advance — February 17, 1891.)

Cotype.— No. 244,718, ♀; British Columbia, Chilliwack; 4 October, 1889; A. C. Brooks.

Cotype.— No. 245,610, ♂; British Columbia, Chilliwack; 21 September, 1887; A. C. Brooks.

Scops kennicottii Elliott, Proc. Ac. Nat. Sci. Phil., 1867, p. 69, Sitka, Alaska.

Scops asio bendirei Brewster

now Otus asio bendirei (Brewster)

Scops asio bendirei Brewster, Bull. Nutt. Orn. Club, **7**, January, 1882, p. 31.

Type.— No. 201,546, ♀; California, Marin Co., Nicasio; 24 April, 1877; C. A. Allen.

Megascops xantusi Brewster

now Otus asio xantusi (Brewster)

Megascops xantusi Brewster, Bull. Mus. Comp. Zoöl., **41**, 1902, p. 73.

Type.— No. 247,301, ♂; Lower California, Santa Anita; 3 June, 1896; L. Miller.

† Megascops aspersus Brewster

= Otus trichopsis (Wagler)

Megascops aspersus Brewster, Auk, **5**, 1888, p. 87.

Cotype.— No. 214,125, ♀; Chihuahua, El Carmen; 6 May, 1884; R. R. McLeod.

Cotype.— No. 214,126, ♀ juv.; Chihuahua, El Carmen; 22 August, 1884; R. R. McLeod.

Scops trichopsis Wagler, Isis, 1832, p. 276 (Mexico).

Megascops vinaceus Brewster

now Otus (asio ?) vinaceus (Brewster)

Megascops vinaceus Brewster, Auk, **5**, 1888, p. 88.

Typr.— No. 214,124, ♀; Chihuahua, Durasno; 2 December, 1884; R. R. McLeod.

Otus choliba luctisonus Bangs and Penard

Otus choliba luctisonus Bangs and Penard, Proc. Biol. Soc. Washington, **34**, 1921, p. 89.

Type.— No. 116,530, ♂; Costa Rica, Escazu; 26 November, 1900; C. F. Underwood.

Otus choliba thompsoni Cole

now Otus hastatus thompsoni (Cole)

Otus choliba thompsoni Cole, Bull. Mus. Comp. Zoöl., **50**, 1906, p. 123.

Cotype.— No. 40,099, ♂; Yucatan, Chichen Itza; 29 March, 1904; L. J. Cole.

Cotype.— No. 41,046, ♀; Yucatan, Chichen Itza; 1890; P. Perera.

Scops brasilianus cassini Ridgway

now Otus cassini (Ridgway)

Scops brasilianus e. *cassini* Ridgway, Proc. U. S. Nat. Mus., **1**, 1878, p. 102.

Cotype.— No. 12,372; Mexico, Jalapa; 9 April, 1869; R. Montes de Oca.

The other cotype from Mirador, Vera Cruz, is in the United States National Museum.

Our specimen listed above was marked by Ridgway himself at the time he described the species as "Megascops cassini Ridgway Type of red phase."

Otus roboratus Bangs and Noble

Otus roboratus Bangs and Noble, Auk, **40**, 1918, p. 448.

Type.— No. 80,073, ♂; Peru, Bellavista; 25 September, 1916; G. K. Noble.

† Syrnium aluco harterti La Touche

= Strix nivicola (Blyth)

Syrnium aluco harterti La Touche, Bull. B. O. C., **40**, 1919, p. 50.

Type.— No. 131,208, ♂; Hupeh, Changlohsien; 16 October, 1918; La Touche Collection.

Syrnium nivicolum Blyth, Jour. As. Soc. Bengal, **14**, 1845, p. 185.

Rothschild (Nov. Zoöl., **33**, 1926, p. 233) is wholly disinclined to recognize either of the Chinese forms — *harterti* La Touche and *nivipetens* Riley — and Stuart Baker (Fauna of British India, Birds, **4**, 1927, p. 398) does not subdivide *nivicola*.

Through the kindness of the authorities of the U. S. National Museum, I now have before me the three skins belonging to that institution — two from Yunnan, including the type of *nivipetens*, and one from Szetchuan — and am able to compare these with the type of

harterti and one skin collected by Zappey in Szetchuan. No two of these are quite alike in color, as one might expect when dealing with such variable birds as wood owls. All, however, strictly represent one and the same form. I am unable to follow Riley in the slight differences in the structure of the wing that he mentions. These seem to me unimportant and variable. Lastly I fail to see in what manner the Chinese examples differ from *nivicola*, and do not hesitate to relegate both names to synonymy. I am glad to add that Riley now agrees to this.

I am inclined to follow Stuart Baker and keep *Strix nivicola* specifically distinct from *S. aluco*. Rothschild, however, adopts the other course, and considers *aluco* and *nivicola* conspecific.

Syrnium nebulosum helveolum Bangs

now Strix varia helveola (Bangs)

Syrium nebulosum helveolum Bangs, Proc. New Eng. Zoöl. Club, **1**, 1899, p. 31.

Strix varia albogilva Bangs, Auk, **25**, 1908, p. 316, new name for *Syrnium nebulosum helveolum*, because Bangs supposed it preoccupied by *Strix helvola* Lichtenstein, 1842, which of course it is not.

Type.— No. 104,551, ♀ ; Texas, Corpus Christi; 2 February, 1899; F. B. Armstrong.

Ciccaba virgata centralis Griscom

Ciccaba virgata centralis Griscom, Bull. Mus. Comp. Zoöl., **69**, 1929, p. 159.

Type.— No. 238,212, ♂; Mexico, Oaxaca, Chivela; 14 May, 1927; W. W. Brown.

Strix virgata tamaulipensis Phillips

now Ciccaba virgata tamaulipensis (Phillips)

Strix virgata tamaulipensis Phillips, Auk, **28**, 1911, p. 76.

Type.— No. 49,982, ♂; Tamaulipas, Rio Martinez; 25 February, 1909; F. B. Armstrong.

Athene noctua impasta Bangs and Peters

Athene noctua impasta Bangs and Peters, Bull. Mus. Comp. Zoöl., **68**, August, 1928, p. 330.

Type.— No. 239,416, ♀ ; grasslands south of Lake Kokonor, 10,700 feet; September, 1925; Joseph F. Rock.

† Speotyto bahamensis Maynard

= Speotyto floridana floridana (Ridgway)

Speotyto bahamensis Maynard, App. to Cat. Birds West Ind., Nov. 29, 1899, p. 33.

Speotyto cunicularia cavicola Bangs, Auk, **17**, 1900, p. 287, new name for *S. bahamensis* Maynard nec, Cory, Auk, **8**, 1891, p. 351, Inagua, Bahamas.

Type.— No. 103,350, ♀; Bahama Islands, Nassau; 6 April, 1897; C. J. Maynard.

Maynard named the New Providence bird as a new species. He did not refer it to the already named Inagua form, *S. c. bahamensis* Cory, which he evidently overlooked. When I detected this I supposed (I don't now know why) that the New Providence and Inagua forms were different, and so renamed Maynard's bird.

Ridgway now considers both names to be synonyms of *floridana*, in which view he is probably right.

Speotyto cunicularia guadeloupensis Ridgway

now Speotyto guadeloupensis guadeloupensis Ridgway

Speotyto cunicularia var. *guadeloupensis* Ridgway, Baird, Brewer and Ridgway, Hist. North Am. Birds, **3**, 1874, p. 90 footnote.

Type.— No. 74,167, Lafresnaye Collection, no. 787; Lesser Antilles, "Guadeloupe"; l'Herminier.

This bird really never occurred in Guadeloupe and l'Herminier must have got his specimen from Marie Galante, a drier and more arid isle near by, where the species formerly occurred, but is now entirely extinct.

Gymnasio lawrencii exsul Bangs

Gymnasio lawrencii exsul Bangs, Proc. New Eng. Zoöl Club. **4**, 1913, p. 91.

Type.— No. 113,469, ♂; Isle of Pines, near Cuba, "*Santa Seville,*" (no such place on any map, must have been the name of some plantation); 31 May, 1904; W. R. Zappey.

Ridgway did not recognize this form. Todd (Ann. Carnegie Mus., **10**, 1916, p. 234), however, agrees with me that the form is well marked and easily to be distinguished from true *lawrencii*.

Glaucidium gnoma hoskinsii Brewster

Glaucidium gnoma hoskinsii Brewster, Auk, **5**, 1888, p. 136.

Type.— No. 214,153, ♂; Lower California, Sierra de la Laguna; 10 May, 1887; M. A. Frazar.

TYTONIDAE

Strix lulu Peale

Strix lulu Peale, U. S. Expl. Exped., **8**, 1848, p. 74.

Cotype.— No. 75,665; Samoan Islands; T. R. Peale.

Peale said, "We obtained numerous specimens, which vary but little." There must, therefore, be cotypes other than ours.

Strix pratincola Bonaparte

now Tyto alba pratincola (Bonaparte)

Strix Pratincola Bonaparte, Geog. and Comp. List, 1838, p. 7.

Type.— No. 67,849 (the original of Wilson's figure). From the old Peale Museum.

Bonaparte in naming the American Barn Owl, gave as his first reference, *Strix flammea* Wilson. As the specimen listed above is the one figured and described by Wilson, it is Bonaparte's type. It is one of the very interesting specimens from the old Peale Museum.

† Hybris nigrescens noctividus Barbour

= Tyto insularis insularis (Pelzeln)

Hybris nigrescens noctividus Barbour, Proc. Biol. Soc. Washington, **24**, 1911, p. 57.

Type.— No. 53,586, ♂; Lesser Antilles, Grenada, St. George; 15 September, 1910; G. M. Allen.

Strix insularis Pelzeln, Journ. für Orn., **20**, 1872, p. 23.

At the time Dr. Barbour described this well-marked island form, Pelzeln's *insularis* was believed to have come from St. Vincent in the Cape Verde Islands. Not until Hellmayr examined the type, was this mistake corrected.

LORIIDAE

Trichoglossus rosenbergi Schlegel

now Trichoglossus haematod rosenbergi (Schlegel)

Trichoglossus rosenbergi Schlegel, Ned. Tijdschr. Dierk., **4**, 1871, p. 9.

Cotype.— No. 39,752, ♂; Schouten Islands, Sock; March, 1869; von Rosenberg.

This specimen was exchanged to us from the Leyden Museum years ago, as one of the "types," and as no holotype was originally designated, it must be considered a cotype.

PSITTACIDAE

Ara rubrogenys Lafresnaye

Ara rubrogenys Lafresnaye, Rev. Zoöl., 1847, p. 65.

Type.— No. 74,329, Lafresnaye Collection, no. 9. Label — "Ara Rubro-genys nob. sev. 1847. L'ara aux joues rouges. Bolivie — d'Orbiny et Parzudaki."

Lafresnaye states (loc. cit., p. 65) that this species was brought to the museum for the first time by d'Orbigny, but he certainly does not designate the specimen in the Paris Museum as the type of his description, and we cannot accept Des Murs' authority for this (Icon. Orn., pl. 72, 1848). It is evident from the label that Lafresnaye drew his description from the specimen that he himself received from Parzudaki, and not from the one in Paris. The figure in Des Murs' Iconographie was made from the bird in the Paris Museum, but the type of the species is surely Lafresnaye's own specimen now in the Museum of Comparative Zoölogy. This is made clear by Lafresnaye's description, which agrees minutely with his own specimen, especially as to the color and markings of the lower underparts, and does not well agree with the specimen figures by Des Murs.

Ara castaneifrons Lafresnaye

now Ara severa castaneifrons (Lafresnaye)

Ara castaneifrons Lafresnaye, Rev. Zoöl., 1847, p. 66.

Type.— No. 74,330, Lafresnaye Collection, no. 10; "Bolivie-Dellattre."

Hellmayr (Abk, K. Bayer Akad. Wis., 1906, p. 578) has fixed Brazil as the type locality of *Ara severa* (Linné). For the characters of the present form see Bangs and Penard (Bull. Mus. Comp. Zoöl., 1917, p. 47).

Aratinga wagleri transilis Peters

Aratinga wagleri transilis Peters, Proc. New Eng. Zoöl. Club, **9**, 1927, p. 111.

Type.— No. 249,706, ♂; Northeast Venezuela, Cuchivano; 24 February, 1925; Tate and Clement.

Aratinga holochlora brewsteri Nelson

Aratinga holochlora brewsteri Nelson, Proc. Biol. Soc. Washington, **41**, 1928, p. 154.

Type.— No. 224,770, ♂; Chihuahua, Hacienda de San Rafael; 5 May, 1888; M. A. Frazar.

Eupsittula astec vicinalis Bangs and Penard

now Aratinga astec vicinalis (Bangs and Penard)

Eupsittula astec vicinalis Bangs and Penard, Bull. Mus. Comp. Zoöl., **63**, 1919, p. 24.

Type.— No. 48,482, ♂; Tamaulipas, Altamira; 24 December, 1908; F. B. Armstrong.

† Conuropsis carolinensis interior Bangs

= Conuropsis carolinensis ludovicianus (Gmelin)

Conuropsis carolinensis interior Bangs, Proc. New Eng. Zoöl. Club, **4**, 1913, p. 94.

Type.— No. 43,215, ♀; Nebraska, Bald Island; 25 April, 1856; Dr. Hayden.

Psittacus ludovicianus Gmelin, Syst. Nat., **1**, pt. 1, 1788, p. 347.

I now agree with Ridgway (Birds North and Middle America, part 7, 1916, p. 150 footnote) that probably it is best to use Gmelin's name for the western form of the Carolina Paroquet.

Pyrrhura hoffmanni gaudens Bangs

Pyrrhura hoffmanni gaudens Bangs, Proc. Biol. Soc. Washington, **19**, 1906, p. 103.

Type.— No. 109,117, ♂; Panama, Boquete; 3 March, 1901; W. W. Brown.

Psittacula coelestis lucida Ridgway

now Forpus coelestis lucidus (Ridgway)

Psittacula coelestis lucida Ridgway, Proc. U. S. Nat. Mus., **10**, 1888, pp. 532 and 538.

Type.— No. 74,218, Lafresnaye Collection, no. 95; "Colomb."

Psittacula conspicillata Lafresnaye

now Forpus conspicillatus conspicillatus (Lafresnaye)

Psittacula conspicillata Lafresnaye, Rev. Zoöl., 1848, p. 172.

Cotype.— No. 74,334 [adult ♂]; Lafresnaye Collection, no. 98; "Mexique ou Colombie."

Cotype.— No. 74,335 [female or immature male]; Lafresnaye Collection, no. 99; "Colomb. aut Mexique, perrot."

Chapman, very properly, has restricted the type locality of this form to Honda, upper Magdalena River.

Psittacula cyanopygia pallida Brewster

now Forpus cyanopygius pallidus (Brewster)

Psittacula cyanopygia pallida Brewster, Auk, 6 April, 1889, p. 85. (Separates issued in advance— January, 1889.)

Cotype.— No. 214,389, ♂ } Sonora, Alamos; 8 March, 1888; M. A.
Cotype.— No. 214,390, ♀ } Frazar

Psittacula viridissima Lafresnaye

now Forpus passerinus viridissimus (Lafresnaye)

Psittacula viridissima Lafresnaye, Rev. Zoöl., 1848, p. 172.

Type.— No. 74,336, Lafresnaye Collection, no. 93.

The type, a fine specimen, was sent from Caracas by M. Sallé to his mother, from whom Lafresnaye received it.

Amazona leucocephala hesterna Bangs

Amazona leucocephala hesterna Bangs, Bull. Mus. Comp. Zoöl., **60**, 1916, p. 308.

Type.— No. 68,313, ♂; Cayman Brac Island; 15 July, 1911; W. W. Brown.

† Pionus vinaceicollis Lafresnaye

= Amazona collaria (Linné)

Pionus vinaceicollis Lafresnaye, Rev. Zoöl., 1846, p. 321.

Type.— No. 74,228, Lafresnaye Collection, no. 66; "Jamaique."

Psittacus collarius Linné, Syst. Nat., **1**, 1758, p. 102.

Pionus senilis decoloratus Griscom

Pionus senilis decoloratus Griscom, Amer. Mus. Novit., no. 379, 1929, p. 6.

Type.— No. 116,545, ♂; Costa Rica, Pozo Azul de Pirris; 12 June, 1903; C. F. Underwood.

Pionus melanotis Lafresnaye

now Pionopsitta melanotis (Lafresnaye)

Pionus melanotis Lafresnaye, Rev. Zoöl., 1847, p. 67.

Cotype.— No. 74,331, Lafresnaye Collection, no. 72.

Cotype.— No. 74,332, Lafresnaye Collection, no. 73; "bolivie, d'Orbigny."

For these two specimens Lafresnaye wrote similar labels, with his significant "nob." after the name, except that he put the locality upon no. 73 only.

Des Murs (Icon. Orn., 1847, pl. 60) who figured a specimen in the Paris Museum, claims it as the type of Lafresnaye's description. I do not agree to this. Lafresnaye (loc. cit., p. 67) states, "Cette espèce a été rapportée de Bolivie au musée de Paris il y a déja plusieurs années par M. A. d'Orbigny. Son bec fort petit parait avoir été d'une couleur de plomb pale et ses pattes noires. Long. tot. 23 cent., de l'aisle depuis le pli 16 cent." Thus the specimen in the Paris Museum is in no way designated as the type, and I do not consider it even a cotype. Having two examples himself, Lafresnaye would naturally have based his description of the species upon them.

† Coracopsis vasa wulsini Bangs

= Coracopsis vasa drouhardi Lavauden

Coracopsis vasa wulsini Bangs, Proc. New Eng. Zoöl. Club, **11**, 31 Oct., 1929, p. 50.

Type.— No. 78,284, ♂; Western Madagascar, Miandrivazo; 23 June, 1915; F. R. Wulsin.

Coracopsis vasa drouhardi Lavauden, Alauda **1**, no. 4, 10 Sept., 1929, p. 231.

Coracopsis nigra libs Bangs

Coracopsis nigra libs Bangs, Proc. New Eng. Zoöl. Club, **9**, 1927, p. 83.

Type.— No. 77,289, ♀; Western Madagascar, Miandrivazo; 22 June, 1915; F. R. Wulsin.

Tanygnathus lucionensis horrisonus Bangs and Peters

Tanygnathus lucionensis horrisonus Bangs and Peters, Occ. Papers Bost. Soc. N. H., **5**, 1927, p. 236.

Type.— No. 235,875, ♂; Maratua Island, Dutch Borneo; February-March, 1926; E. Mjöberg.

Platycercus splendens Peale

now Prosopeia splendens (Peale)

Platycercus splendens Peale, U. S. Expl. Exped., 1848, p. 127.

Cotype.— No. 74,343; Fiji Islands; T. R. Peale.

Peale does not say how many specimens he secured. Undoubtedly other cotypes, besides ours, exist.

† Platycercus atrogularis Peale

= Prosopeia tabuensis (Gmelin)

Platycercus atrogularis Peale, U. S. Expl. Exped., 1848, p. 129.

Cotype.— No. 17,732; Fiji Islands; T. R. Peale.
Cotype.— No. 74,344; Fiji Islands; T. R. Peale.

Psittacus tabuensis Gmelin, Syst. Nat., **1**, 1788, p. 317.

Again Peale does not say how many specimens he collected.

Agapornis cana ablectanea Bangs

Agapornis cana ablectanea Bangs, Bull. Mus. Comp. Zoöl., **61**, 1918, p. 503.

Type.— No. 78,302, ♂; western Madagascar, Morondava Delta; 24 July, 1915; F. R. Wulsin.

Loriculus sclateri ruber Meyer and Wiglesworth

Loriculus sclateri ruber Meyer and Wiglesworth, Abh. u. Ber. Mus. Dresden, **6**, 1897, no. 2, p. 9.

Cotype.— No. 97,344; Banzaai Island; May-August, 1895; Corsham.

This specimen, when received by the Museum of Comparative Zoölogy, was said to be one of the "types." As no holotype was designated in the original description, our skin is a cotype.

Nymphicus uvæensis E. L. and E. L. C. Layard

Nymphicus uvæensis E. L. and E. L. C. Layard, P. Z. S., 1882, p. 408, pl. 26 fig. 2.

Cotype.— No. 142,238; Loyalty Islands, Uvéa; E. L. Layard.

Our cotype is one of the two cage birds, ♂ and ♀, upon which the Layards based their description of the species. The other cotype is still in the collection of the Philadelphia Academy of Natural Sciences, from which we received ours in exchange.

The birds passed from the hands of the Layards into the Tristam Collection, and thence into the possession of the Philadelphia Academy.

CORACIIDAE

Brachypteracias squamigera Lafresnaye

now Geobiastes squamigera (Lafresnaye)

Brachypteracias squamigera Lafresnaye, Rev. Zoöl., 1838, p. 224.

Type.— No. 74,871, Lafresnaye Collection, no. 2027; "Madagascar."

I fail to understand upon what grounds Grandidier (Hist. Madagascar, **1**, 1879, p. 243) claims the type of this species for the Paris Museum. Lafresnaye's written label for his own specimen leaves no doubt that it was the one from which he described the species.

Brachypteracias pittoides Lafresnaye

now Atelornis pittoides (Lafresnaye)

Brachypteracias pittoides Lafresnaye, Mag. Zoöl., 1834, pl. 32, text.

Type.— No. 74,870, Lafresnaye Collection, no. 2,029; "Madagascar."

Grandidier (Hist. Madagascar, **1**, 1879, p. 246) also claims the type of this species for the Paris Museum, in my opinion wholly without justification. Lafresnaye's written label for his specimen with the significant "nob." after the name leaves no doubt that his own specimen is the actual type.

ALCEDINIDAE

Ceyx cyanopectus Lafresnaye

Ceyx cyano-pectus Lafresnaye, Rev. Zoöl., 1840, p. 33.

Type.— No. 76,367; Lafresnaye Collection, no. 1,951.

Lafresnaye did not know whence his specimen, fine adult male,

came. I have carefully compared it and find it identical with examples from Luzon, and, therefore, designate Luzon as the type locality.

Entomothera coromanda bangsi Oberholser

now Halcyon coromanda bangsi (Oberholser)

Entomothera coromanda bangsi Oberholser, Proc. U. S. Nat. Mus., **48**, 1915, p. 654.

Type.— No. 40,990, ♂, Loo-choo Islands, Ishigaki; 23 April, 1899; I. Zensaku.

† Dacelo fuscicapilla Lafresnaye

= Halcyon albiventris albiventris (Scopoli)

Dacelo fuscicapilla Lafresnaye, Mag. Zoöl., 1833, pl. 18, text.

Type.— No. 76,207; Lafresnaye Collection, no. 1,838. "Cap. b. spei.— Verreaux."

Alcedo albiventris Scopoli, Del. Flor. et Faun. Insubr., **2**, 1786, p. 90.

Dacelo vitiensis Peale

now Halcyon sacra vitiensis (Peale)

Dacelo vitiensis Peale, U. S. Expl. Exped., 1848, p. 156.

Cotype.— No. 75,709; Fiji Islands; T. R. Peale.

Peale appears to have taken several specimens, our cotype is a fine adult.

† Dacelo coronata Peale

now Halcyon pealei Finsch & Hartlaub

Dacelo coronata Peale, U. S. Expl. Exped., 1848, p. 160 (Not *Halcyon coronata* S. Müller, 1843).

Halcyon pealei Finsch and Hartlaub, Faun. Centralpol., 1867, p. 40. (New name to replace *Dacelo coronata* Peale, preoccupied).

Cotype.— No. 75,711, ♀ ; Samoa, Tutuila; T. R. Peale.

Another example, no. 75,710, is labeled simply "Samoan Islands," and as Peale says that the birds he described were from Tutuila, I do not list it as a cotype.

† Dacelo albifrons Peale

= Halcyon sanctus vagans (Lesson)

Dacelo albifrons Peale, U. S. Expl. Exped., 1848, p. 162.

Cotype.— No. 75,704, ♂; New Zealand, Bay of Islands; T. R. Peale.

Alcedo vagans Lesson, Voy. de la Coquille, Zoöl., **1**, 1830, p. 694.

Todiramphus recurvirostris Lafresnaye

Todiramphus recurvirostris Lafresnaye, Rev. Zoöl., 1842, p. 134.

Cotype.— No. 76,209; Lafresnaye Collection, no. 1,880, "isle des navigateurs."

Cotype.— No. 76,210; Lafresnaye Collection, no. 1,881, "iles des navigateurs" [= Samoa].

† Dacelo minima Peale

= Todiramphus recurvirostris Lafresnaye

Dacelo minima Peale, U. S. Expl. Exped., 1848, p. 159.

Cotype.— No. 75,712, ♂; Samoa, Upolu; T. R. Peale.

Todiramphus recurvivostris Lafresnaye, Rev. Zoöl., 1842, p. 134.

BUCEROTIDAE

† Tockus poecilorhynchus Lafresnaye

= Lophoceros nasutus nasutus (Linné)

Tockus poecilorhynchus Lafresnaye, Rev. Zoöl., 1839, p. 257.

Type.— No. 76,179; Lafresnaye Collection, no. 1,156, "Senegal."

Buceros nasutus Linné, Syst. Nat., 1766, p. 154.

Bycanistes cristatus brevis Friedmann

Bycanistes cristatus brevis Friedmann, Proc. New Eng. Zoöl. Club, **11**, 1929, p. 32.

Type.— No. 237,551, ♂; Tanganyika Territory, Mt. Lutindi, Usambara Mountains; 10 December, 1926; Arthur Loveridge.

PHOENICULIDAE

Rhinopomastus minor extimus Friedmann

Rhinopomastus minor extimus Friedmann, Proc. New Eng. Zoöl. Club, **11**, 1929, p. 29.

Type.— No. 133,557, ♂; Tanganyika Territory, Dodoma; 25 December, 1918; Arthur Loveridge.

MEROPIDAE

Merops lafresnayii Guérin

now Melittophagus lafresnayii lafresnayii (Guérin)

Merops Lafresnayii Guérin, Rev. Zoöl., 1843, p. 332.

Type.— No. 74,866; Lafresnaye Collection, no. 754; "abyssinie."

For this specimen Lafresnaye wrote a lengthy label, telling its history, giving a great deal of synonymy and making notes on how it differed from all other forms known to him.

† Merops sumatranus coeligenus Bangs and Penard

= Merops viridis viridis Linné

Merops sumatranus coeligenus Bangs and Penard, Proc. New Eng. Zoöl. Club, **8**, 1923, p. 80.

Type.— No. 60,323, ♂; Java, Pelaboean Ratoe; 10 October, 1909; O. Bryant and W. Palmer.

Merops viridis Linné, Syst. Nat., 1758, p. 117.

Penard and I stupidly overlooked the changes in names pointed out by Hartert (Nov. Zoöl., **17**, 1910, p. 482) and, therefore, renamed the Javan form.

MOMOTIDAE

Electron carinatus viridis Ridgway

Electron carinatus viridis Ridgway, Proc. Biol. Soc. Washington, **25**, 1912, p. 89.

Type.— No. 121,067, ♂; Costa Rica, La Vijagua; 3 March, 1908; C. F. Underwood.

† Momotus yucatanensis Cabot

= Eumomota superciliosa superciliosa (Sandbach)

Momotus yucatanensis Cabot, Proc. Bost. Soc. N. H., **1**, 1843, p. 156.

Cotype.— No. 72575; Yucatan; S. Cabot.
Cotype.— No. 88809; Yucatan; S. Cabot.

Pyronites superciliosus Sandbach, Athenaeum, no. 517, 1837, p. 698.

At the time I wrote an account of Cabot's Types of Yucatan Birds (Auk, **32**, 1915, p. 168) we could find only one specimen, since then another has turned up among some Yucatan birds of Cabot's collecting, that had been kept ever since in the Cabot family.

Eumomota superciliosa euroaustris Griscom

Eumomota superciliosa euroaustris Griscom, Proc. New Eng. Zoöl. Club, **11**, 1929, p. 54.

Type.— No. 136,585, ♂; Honduras, Lancetilla; 6 March, 1928; J. L. Peters.

Eumomota superciliosa dickeyi Griscom

Eumomota superciliosa dickeyi Griscom, Proc. New Eng. Zoöl. Club, **11**, 1929, p. 55.

Type.— No. 36,530; Honduras, Copan; 1891; G. Lopez.

Eumomota superciliaris australis Bangs

now Eumomota superciliosa australis Bangs

Eomomota superciliaris australis Bangs, Proc. Biol. Soc. Washington, **19**, 1906, p. 104.

Type.— No. 116,499, ♂; Costa Rica, Bebedero; 11 February, 1890; C. F. Underwood.

Momotus conexus Thayer and Bangs

now *Momotus momota conexus* Thayer and Bangs

Momotus conexus Thayer and Bangs, Bull. Mus. Comp. Zoöl., **46**, 1906, p. 215

Type.— No. 114,054, ♀; Panama, Panama; 6 May, 1904; W. W. Brown.

Prionites gularis Lafresnaye

now Aspatha gularis (Lafresnaye)

Prionites gularis Lafresnaye, Rev. Zoöl., 1840, p. 130.

Type.— No. 76,241; Lafresnaye Collection, no. 2,007; "Mexique guatemala."

TODIDAE

† Todus dominicensis Lafresnaye

= Todus subulatus (Gray)

Todus Dominicensis Lafresnaye, Rev. Zoöl., 1847, p. 331.

Type.— No. 76,245; Lafresnaye Collection, no. 5,097; "St. Dom. M. Salé."

Todus subulatus Gray, Gen. Birds, April, 1847, p. 63.

Two other specimens, Lafresnaye Collection, nos. 5,096 and 5,098 are not cotypes. They have wholly differently worded labels, and were probably received by Lafresnaye at a later date.

Todus angustirostris Lafresnaye

Todus angustirostris Lafresnaye, Rev. et Mag. Zoöl., 1851, p. 478.

Type.— No. 76,242; Lafresnaye Collection, no. 5,101; "St. Dominque, M. Salé." A second specimen, no. 5,102, is not a cotype.

In an article in P. Z. S. (1857, p. 233) Sallé expressed the opinion that *T. subulatus*, *T. dominicensis* and *T. angustirostris* represented only different ages and sexes of one and the same species. It, of course, is now known that *T. subulatus* and *T. angustirostris* are distinct species, and that *T. dominicensis* is a synonym of *T. subulatus*.

Todus multicolor exilis Barbour and Brooks

= Todus multicolor Gould

Todus multicolor exilis Barbour and Brooks, Proc. New Eng. Zoöl. Club, **6**, 1917, p. 51.

Type.— No. 67,263, ♀; Cuba, Preston (Nipe Bay); 5 March, 1915; J. L. Peters.

Todus multicolor Gould, Icon. Av., 1837, pl. 2.

The large amount of material that has come into this museum since Barbour and Brooks named their *exilis* proves that the two characters

upon which the form was based are very variable, perhaps due to age or season and perhaps purely individual. We find now that it is impossible to maintain an eastern and western form in Cuba.

CAPRIMULGIDAE

Caprimulgus americanus Wilson

= Chordeiles minor minor (J. R. Forster)

Caprimulgus americanus Wilson, Am. Orn., **5**, 1812, p. 65, pl. 40, fig. 1 (not of Linné, Syst. Nat., ed. 10, **1**, 1758, p. 193).

Type.— No. 67,855, from the old Peale Museum.

Caprimulgus minor J. R. Forster, Cat. Anim. N. Am., 1771, p. 13.

† Chordeiles peruvianus Peale

= Chordeiles acutipennis exilis (Lesson)

Chordeiles peruvianus Peale, U. S. Expl. Exped., 1848, p. 172.

Cotype.— No. 75,697, ♂; Peru; T. R. Peale.

Caprimulgus exilis Lesson, Rev. Zoöl., 1839, p. 44.

Nyctidromus albicollis intercedens Griscom

Nyctidromus albicollis intercedens Griscom, Am. Mus. Novit., no. 379, 1929, p. 8.

Type.— No. 136,601, ♂; Honduras, Tela; 4 March, 1928; James L. Peters.

Nyctidromus albicollis gilvus Bangs

Nyctidromus albicollis gilvus Bangs, Proc. New Eng. Zoöl. Club, **3**, 1902, p. 82.

Type.— No. 105,201, ♂; Colombia, Santa Marta Mountains; 5 January, 1898; W. W. Brown.

† Phalaenoptilus nuttalli nitidus Brewster

= Phalaenoptilus nuttalli nuttalli (Audubon)

Phalaenoptilus nuttalli nitidus Brewster, Auk, **4**, 1887, p. 147.

Cotype.— No. 213,076, ♂; Texas, Nueces River; 27 February, 1886; F. B. Armstrong.

Cotype.— No. 213,077, ♀; Texas, Nueces River; 27 February, 1886; F. B. Armstrong.

Caprimulgus nuttalli Audubon, Birds Am., **7**, 1844, p. 350, pl. 495.

Otophanes mcleodii Brewster

Otophanes mcleodii Brewster, Auk, **5**, 1888, p. 89.

Type.— No. 214,123, ♀; Chihuahua, Sierra Madre; 6 December, 1884; R. R. McLeod.

† Caprimulgus aequicauda Peale

= Systellura decussata (Tschudi)

Caprimulgus aequicauda Peale, U. S. Expl. Exped., 1848, p. 168.

Cotype.— No. 75,698; Peru; T. R. Peale

Caprimlugus decussatus Tschudi, Arch. f. Naturg., 1844, p. 268.

Peale does not tell us how many specimens he secured; probably there are other cotypes besides ours.

Antrostomus vociferus arizonae Brewster

now Caprimulgus vociferus arizonae (Brewster)

Antrostomus vociferus arizonae Brewster, Bull. Nutt. Orn. Club, **6**, 1881, p. 69.

Type.— No. 205,238, ♂; Arizona, Chiricahua Mountains; 22 May, 1880; F. Stephens.

Antrostomus badius Bangs and Peck

now Caprimulgus badius (Bangs and Peck)

Antrostomus badius Bangs and Peck, Proc. Biol. Soc. Washington, **21**, 1908 p. 44.

Type.— No. 119,990, [♀]; British Honduras, Toledo District; 2 January, 1907; M. E. Peck.

† Antrostomus nelsoni Ridgway

= Caprimulgus badius (Bangs and Peck)

Antrostomus nelsoni Ridgway, Proc. Biol. Soc. Washington, **25**, 1912, p. 90.

Type.— No. 40,093, ♂; Yucatan, Chichen-Itza; 29 March, 1904; L. J. Cole.

Antrostomus badius Bangs and Peck, Proc. Biol. Soc. Washington, **21**, 1908, p. 44.

ANTROSTOMUS RUFUS OTIOSUS Bangs

now CAPRIMULGUS RUFUS OTIOSUS (Bangs)

Antrostomus rufus otiosus Bangs, Proc. Biol. Soc. Washington, **24**, 1911, p. 188.

Type.— No. 28,674, [♂]; Lesser Antilles, St. Lucia; J. Semper.

† CAPRIMULGUS ELEANORAE Phillips

= CAPRIMULGUS TRIMACULATUS TRISTIGMA Rüppell

Caprimulgus eleanorae Phillips, Proc. Biol. Soc. Washington, **26**, 1913, p. 167.

Type.— No. 63,436, ♀; East Sudan, Blue Nile, Fazogli; 15 January, 1913; G. M. Allen and J. C. Phillips.

Caprimulgus tristigma Rüppell, Neue Wirb., Vog., 1840, p. 105.

APODIDAE

COLLOCALIA INOPINA Thayer and Bangs

now COLLOCALIA INOPINA INOPINA Thayer and Bangs

Collocalia inopina Thayer and Bangs, Bull. Mus. Comp. Zoöl., **52**, 1909, p. 139.

Type.— No. 50,014, ♂; China, Hupeh, Mafuling; 1 June, 1907; W. R. Zappey.

COLLOCALIA INOPINA PELLOS Thayer and Bangs

Collocalia inopina pellos Thayer and Bangs, Mem. Mus. Comp. Zoöl., **40**, 1912, p. 158.

Type.— No. 52,131, ♂; China, Western Szechuan, Ching Chow Hsien; 4 April, 1908; W. R. Zappey.

COLLOCALIA FUSCIPHAGA CAPNITIS Thayer and Bangs

now COLLOCALIA FRANCICA CAPNITIS Thayer and Bangs

Collocalia fusciphaga capnitis Thayer and Bangs, Bull. Mus. Comp. Zoöl., **52**, 1909, p. 139.

Type.— No. 50,013, ♂; China, Hupeh, Wantaoshan; 5 June, 1907; W. R. Zappey.

Macropteryx spodiopygius Peale

now Collocalia francica spodiopygius (Peale)

Macropteryx spodiopygius Peale, U. S. Expl. Exped., 1848, p. 176.

Cotype.— No. 75,700; Samoa, Tutuila; T. R. Peale.

I have no idea how many specimens Peale secured, but in all probability there exist other cotypes besides ours.

Macropteryx leucophæus Peale

now Collocalia francica leucophæus (Peale)

Macropteryx leucophæus Peale, U. S. Expl. Exped., 1848, p. 178.

Cotype.— No. 75,699, ♂; Tahiti; T. R. Peale.

Again Peale does not say how many he took.

† Streptoprocne zonaris melanotis Peters

= Streptoprocne zonaris pallidifrons (Hartert)

Streptoprocne zonaris melanotis Peters, Proc. New Eng. Zoöl. Club, **6**, 1916, p. 37.

Type.— No. 70,116, ♂; Santo Domingo, Sosua; 28 February, 1916; J. L. Peters.

Chaetura zonaris pallidifrons Hartert, Ibis, 1896, p. 368.

Chaetura brachyura praevelox Bangs and Penard

Chaetura brachyura praevelox Bangs and Penard, Bull. Mus. Comp. Zoöl., **62**, 1918, p. 60.

Type.— No. 112,817, ♂; Lesser Antilles, St. Vincent; 14 October, 1903; A. H. Clark.

Chaetura brunnitorques Lafresnaye

now Cypseloides brunnitorques brunnitorques (Lafresnaye)

Chaetura brunnitorques (*sic*) Lafresnaye, Rev. Zoöl., 1844, p. 81.

Type.— No. 76,240; Lafresnaye Collection, no. 893 "Colombie."

† APUS MELBA PETRENSIS Bangs

= APUS MELBA TUNETI Tschusi

Apus lemba petrensis Bangs, Proc. Biol. Soc. Washington, **24**, 1911, p. 195.

Type.— No. 59,534; Palestine, Jordan Valley; April, 1886; Selah Merrill Collection.

Apus melba tuneti Tschusi, Orn. Jarb., **15**, 1904, p. 123.

TROCHILIDAE

HEMISTEPHANIA GINANENSIS Boucard

= DORYFERA JOHANNAE (Bourcier)

Hemistephania ginanensis (*sic*) Boucard, Hummingbird, **3**, 1893, p. 10.

Cotype.— No. 82,538, ♂; British Guiana, Merumé Mountains; 21 July, 1881; H. Whitely.

Trochilus johannae Bourcier, P. Z. S., 1847, p. 45.

This specimen is one of Boucard's marked cotypes.

THRENETES RUCKERI DARIENENSIS Bangs and Barbour

Threnetes ruckeri darienensis Bangs and Barbour, Bull. Mus. Comp. Zoöl., **65**, 1922, p. 204.

Type.— No. 87,511, ♂; Panama, Darien, Mount Sapo; 23 April, 1922; Barbour, Brooks, and Underwood.

THRENETES RUCKERI VENTOSUS Bangs and Penard

Threnetes ruckeri ventosus Bangs and Penard, Occ. Papers Bost. Soc. N. H., **5**, 1924, p. 77.

Type.— No. 116,624, ♂; Costa Rica, Pozo Azul; 21 February, 1898; C. F. Underwood.

HETEROGLAUCIS PHILIPPINÆ Penard

now GLAUCIS PHILIPPINÆ (Penard)

Heteroglaucis philippinæ Penard, Proc. New Eng. Zoöl. Club, **8**, 1922, p. 27.

Type.— No. 86,893; Surinam, Lelydorp; 13 September, 1921; A. Pichot.

Penard described this bird as a *Heteroglaucis*, but failed to note that

the mandibles are serrated, and further that the bill is heavy and hooked as in *Glaucis*. *Heteroglaucis* is too close to *Threnetes* to stand even as a subgenus. The type specimen is unique, it may prove to be an extremely abnormal example of *Glaucis hirsuta*, or perhaps it may represent a rare and distinct species.

Phaethornis guy coruscus Bangs

Phaethornis guy coruscus Bangs, Proc. New Eng. Zoöl. Club, **3**, 1902, p. 26.

Type.— No. 108,414, ♂; Panama, Boquete; 14 March, 1901; W. W. Brown.

Phaethornis longirostris susurrus Bangs

now Phaethornis superciliosus susurrus Bangs

Phaethornis longirostris susurrus Bangs, Proc. New Eng. Zoöl. Club, **2**, 1901, p. 64.

Type.— No. 106,806, ♂; Colombia, Santa Marta Mountains, Chirua; 17 January, 1899; W. W. Brown.

Phaethornis hyalinus Bangs

now Phaethornis anthophila hyalinus (Bangs)

Phaethornis hyalinus Bangs, Auk, 1901, p. 27.

Type.— No. 104,922, ♂; San Miguel Island, Pearl Islands, Bay of Panama; 5 May, 1900; W. W. Brown.

Campylopterus hemileucurus mellitus Bangs

Campylopterus hemileucurus mellitus Bangs, Proc. New Eng. Zoöl. Club, **3**, 1902, p. 28.

Type.— No. 108,425, ♂; Panama, Boquete; 10 April, 1901; W. W. Brown.

Thaumasius taczanowskii fractus Bangs and Noble

now Talaphorus taczanowskii fractus (Bangs and Noble)

Thaumasius taczanowskii fractus Bangs and Noble, Auk, **35**, 1918, p. 451.

Type.— No. 80,118, ♂; Peru, Huancabamba; 9 August, 1916; G. K. Noble.

† Saucerottea cyanura impatiens Bangs

= Saucerottia cyanura cyanura (Gould)

Saucerottea cyanura impatiens Bangs, Proc. Biol. Soc. Washington, **19**, 1906, p. 104.

Type.— No. 116,684, ♂; Costa Rica, San Pedro; October, 1904; C. F. Underwood.

Amazilia cyanura Gould, Monog. Troch., **5**, 1859, pl. 315.

Trochilus yucatanensis Cabot

now Amizilis yucatanensis yucatanensis (Cabot)

Trochilus yucatanensis Cabot, Proc. Bost. Soc. N. H., **2**, 1845, p. 74.

Type.— No. 72,512; Yucatan; Dr. S. Cabot.

Amizilis bangsi Ridgway

= Hybrid: Amizilis rutila (Delattre) × Amizilis tzacatl tzacatl (De la Llave)

Amizilis bangsi Ridgway, Proc. Biol. Soc. Washington, **23**, 1910, p. 54.

Type.— No. 116,682, ♂; Costa Rica, Volcan de Miravalles; 7 September, 1895; C. F. Underwood.

Simon (1921, p. 106) gives it as his opinion, without, however, having seen the type, that *bangsi* is simply an example of *rutila* with an undue amount of green feathers on the sides of the breast. I do not think that this is so, but regard the type, which is unique, as a hybrid. The type in its coloring is nearly intermediate between *A. rutila* and *A. tzacatl*, both of which are common birds in the region whence it came.

Cyanomyia salvini Brewster

now Amizilis salvini (Brewster)

Cyanomyia salvini Brewster, Auk, **10**, 1893, p. 214.

Type.— No. 224,125, ♂; Sonora, Nacosari; 31 March, 1887; John C. Cahoon.

Hylocharis leucotis borealis Griscom

Hylocharis leucotis borealis Griscom, Am. Mus. Novit., no. 379, 1929, p. 10.

Type.— No. 224,208, ♂; Chihuahua, Pinos Altos; 2 July, 1888; M. A. Frazar.

† Hylocharis guianensis Boucard

= Hylocharis sapphirina (Gmelin)

Hylocharis guianensis Boucard, Hummingbird, **1**, 1891, p. 52.

Cotype.— No. 94,715, ♀; British Guiana, Camacusa; 22 April, 1882; H. Whitely.

Trochilus sapphirinus Gmelin, Syst. Nat., **1**, 1788, p. 496.

This specimen is labeled by Boucard as one of his cotypes.

Chalybura buffoni micans Bangs and Barbour

Chalybura buffoni micans Bangs and Barbour, Bull. Mus. Comp. Zoöl., **65**, 1922, p. 204.

Type.— No. 87,514, ♂; Panama, Darien, Mount Sapo; 25 April, 1922; Barbour, Brooks and Underwood.

Anthracothorax prevostii gracilirostris Ridgway

Anthracothorax prevostii gracilirostris Ridgway, Proc. Biol. Soc. Washington, **23**, 1910, p. 55.

Type.— No. 122,629, ♂; Costa Rica, Bolson; 16 December, 1907; C. F. Underwood.

Aithurus scitulus Brewster and Bangs

now Trochilus scitulus (Brewster and Bangs)

Aithurus scitulus Brewster and Bangs, Proc. New Eng. Zoöl. Club, **2**, 1901, 1901, p. 49.

Type.— No. 37,405, ♂; Jamaica, Priestmans River; 11 February, 1891; W. E. D. Scott.

Leucuria phalerata Bangs

now Helianthea phalerata (Bangs)

Leucuria phalerata Bangs, Proc. Biol. Soc. Washington, **12**, 1898, p. 174.

Type.— No. 105,731, ♂; Colombia, Santa Marta Mountains, Macotama; 17 June, 1898; W. W. Brown.

Lafresnayea liriope Bangs

now Lafresnayea lafresnayi liriope Bangs

Lafresnayea liriope Bangs, Proc. Biol. Soc. Washington, **23**, 1910, p. 105.

Type.— No. 106,216, ♂; Colombia, Santa Marta Mountains, Paramo de Chiruqua; 25 February, 1899; W. W. Brown.

Metallura districta Bangs

Metallura districta Bangs, Proc. Biol. Soc. Washington, **13**, 1899, p. 94.

Type.— No. 106,223, ♀; Colombia, Santa Marta Mountains, San Miguel; 6 February, 1899; W. W. Brown.

† Trochilus bahamensis Bryant

= Nesophilox evelynae (Bourcier)

Trochilus bahamensis Bryant, Proc. Bost. Soc. N. H., **7**, 1859, p. 106.

Cotype.— No. 46,812, ♂; Bahamas, Nassau; 2 March, 1859; H. Bryant.

Cotype.— No. 46,813, ♀; Bahamas, Nassau; 15 February, 1859; H. Bryant.

Trochilus evelynae Bourcier, P. Z. S., 1847, p. 44.

† Trochilus violajugulum J. A. Jeffries

= Hybrid: Archilochus alexandri (Bourcier and Mulsant) × Calypte annae (Lesson)

Trochilus violajugulum Jeffries, Auk, **5**, 1888, p. 168.

Type.— No. 40,932 ♂; California, Santa Barbara; 5 April, 1883; J. A. Jeffries.

Selasphorus simoni Carriker

Selasphorus simoni Carriker, Ann. Carn. Mus., **6**, 1910, p. 550.

Type.— No. 116,879, ♂; Costa Rica, Barba; October, 1900; C. F. Underwood.

Acestrura astreans Bangs

Acestrura astreans Bangs, Proc. New Eng. Zoöl. Club, **1**, 1899, p. 76.

Type.— No. 106,840, ♂; Colombia, Santa Marta Mountains, San Sebastian; 16 July, 1899; W. W. Brown.

TROGONIDAE

Pharomacrus festatus Bangs

now Pharomacrus fulgidus festatus Bangs

Pharomacrus festatus Bangs, Proc. Biol. Soc. Washington, **13**, 1899, p. 92.

Type.— No. 106,235, ♂; Colombia, Santa Marta Mountains, Chirua; 20 March, 1899; W. W. Brown.

Prionotelus temnurus vescus Bangs and Zappey.

Prionotelus temnurus vescus Bangs and Zappey, Am. Nat., **39**, 1905, p. 204.

Type.— No. 113,250, ♂; Isle of Pines (near Cuba), Almacigos; 19 April, 1904; W. R. Zappey.

Trogon underwoodi Bangs

Trogon aurantiiventris underwoodi Bangs

Trogon underwoodi Bangs, Proc. New Eng. Zoöl. Club, **4**, 1908, p. 24.

Type.— No. 116,581, ♂; Costa Rica, Volcan de Miravalles; 28 October, 1895; C. F. Underwood.

Trogon melanocephala illaetabilis Bangs

Trogon melanocephala illaetabilis Bangs, Proc. Biol. Soc. Washington, **22**, 1909, p. 30.

Type.— No. 122,781, ♂; Costa Rica, Bolson; 25 December, 1907; C. F. Underwood.

Trogon collaris extimus Griscom

Trogon collaris extimus Griscom, Bull. Mus. Comp. Zoöl., **69**, 1929, p. 162.

Type.— No. 140,533, ♀; Eastern Panama, Cana; 22 March, 1928; Rex R. Benson.

CUCULIDAE

Cuculus gabonensis Lafresnaye

now Cuculus gabonensis gabonensis Lafresnaye

Cuculus gabonensis Lafresnaye, Rev. et Mag. Zoöl., 1853, p. 60.

Type.— No. 76,177; Lafresnaye Collection, no. 1,307 (no data).

Cercococcyx montanus patulus Friedmann

Cercococcyx montanus patulus Friedmann, Proc. New Eng. Zoöl. Club, **10**, 1928, p. 84.

Type.— No. 237,593, ♂; Tanganyika Territory, Uluguru, Bagilo; 28 September, 1926; A. Loveridge.

Coccyzus minor teres Peters

Coccyzus minor teres Peters, Proc. New Eng. Zoöl. Club, **9**, 1927, p. 112.

Type.— No. 70,073, ♂; Santo Domingo, Sosua; 31 March, 1916; J. L. Peters.

Coccyzus minor vincentis Clark

Coccyzus minor vincentis Clark, Proc. Bost. Soc. N. H., **32**, 1905, p. 264.

Type.— No. 112,796, ♂; Lesser Antilles, St. Vincent, Peter's Hope; 11 February, 1904; Austin H. Clark.

Coccyzus minor grenadensis Bangs

Coccyzus minor grenadensis Bangs, Proc. Biol. Soc. Washington, **20**, 1907, p. 53.

Type.— No. 112,978, ♂; Lesser Antilles, Union Island, Clifton; 9 April, 1904; Austin H. Clark.

† Coccyzus lindeni Allen

= Coccyzus julieni Lawrence

Coccyzus lindeni Allen, Bull. Essex Inst., **8**, 1876, p. 81.

Type.— No. 22,886, ♀; Brazil, Santarem; 19 April; Charles Linden.

Coccyzus julieni Lawrence, Ann. Lyc. N. H., N. Y., **8**, 1864, pp. 42 and 98.

† Centropus lafresnayanus J. Verreaux

= Centropus toulou toulou (P. L. S. Müller)

Centropus Lafresnayanus J. Verreaux in Vinson Voyage à Madagascar, 1865, annexe B., pp. 3 and 5.

Cotype.— No. 74,872; Lafresnaye Collection, no. 1,227; Madagascar.
Cotype.— No. 74,873; Lafresnaye Collection, no. 1,226; Madagascar.

Cuculus toulou P. L. S. Müller, Syst. Nat., Suppl., 1776, p. 90.

Verreaux took his description from a bird in black plumage which he says was in the possession of his brother Edward in 1862, and from

two individuals in brown plumage, which he called females, and which he found in the Lafresnaye Collection. All three are, of course, cotypes. I wonder if the black plumaged bird can be or has been traced to any museum!

† Saurothera jamaicensis Lafresnaye
= Saurothera vetula (Linné)

Saurothera Jamaicensis Lafresnaye, Rev. Zoöl., 1847, p. 354.

Type.— No. 84,642; Lafresnaye Collection, no. 1,255; "Jamaique."

Cuculus vetula Linné, Syst. Nat., **1**, 1758, p. 111.

Saurothera merlini decolor Bangs and Zappey

Saurothera merlini decolor Bangs and Zappey, Am. Nat., **39**, 1905, p. 199.

Type.— No. 113,246, ♂; Isle of Pines, near Cuba, La Vega; 24 April, 1904; W. R. Zappey.

Saurothera bahamensis Bryant
now Saurothera merlini bahamensis Bryant

Saurothera bahamensis Bryant, Proc. Bost. Soc. N. H., **9**, 1864, p. 280.

Cotype.— No. 45,971, ♂; Bahamas, Nassau; April, 1859.
Cotype.— No. 45,972, ♀; Bahamas, Nassau; May, 1859.

† Piaya cinnamomeiventris Lafresnaye
= Hyetornis pluvialis (Gmelin)

Piaya cinnamomeiventris Lafresnaye, Rev. Zoöl., 1846, p. 321.

Type.— No. 76,140, Lafresnaye Collection, no. 1,282; "Jamaique."

Cuculus pluvialis Gmelin, Syst. Nat., 1788, p. 411.

The one specimen in the Lafresnaye Collection is not only the type of *Piaya cinnamomeiventris*, but is also the subject of the figure in Des Murs (Icon. Orn., 1848, pl. 65). It is still in excellent condition.

Piaya cayana mogenseni Peters

Piaya cayana mogenseni Peters, Occ. Papers Bost. Soc. N. H., **5**, 1926, p. 195.

Type.— No. 99,263; ♂; Argentina, Tucuman, Concepcion; 12 July, 1922; J. Mogensen.

Piaya rutila panamensis Todd

now Coccycua rutila panamensis (Todd)

Piaya rutila panamensis Todd, Ann. Carnegie Mus., **8**, 1912, p. 212.

Type.— No. 107,100, ♂; Panama, Loma del Leon; 10 March, 1900; W. W. Brown.

† Phoenicophaeus nigriventris Peale

= Rhopodytes diardi (Lesson)

Phoenicophaeus nigriventris Peale, U. S. Expl. Exped., 1848, p. 140.

Cotype.— No. 75,754, from U. S. Expl. Exped.

Melies Diardi, Lesson, Traité, 1831, p. 132.

Peale merely says on page 142 that "specimens were obtained at Singapore," but does not mention how many.

† Anadaenus ruficauda Peale

= Rhinortha chlorophaea chlorophaea (Raffles)

Anadaenus ruficauda Peale, U. S. Expl. Exped., 1848, p. 142.

Cotype.— No. 75,755, from U. S. Expl. Exped.

Cuculus chlorophaeus Raffles, Trans. Linn. Soc., **13**, 1822, p. 288.

Again Peale says only that "specimens were obtained at Singapore."

Crotophaga sulcirostris pallidula Bangs and Penard

Crotophaga sulcirostris pallidula Bangs and Penard, Bull. Mus. Comp. Zoöl., **64**, 1921, p. 365.

Type.— No. 217,148, ♂; Lower California, San José del Cabo; 12 October, 1887; M. A. Frazar.

Although formerly a common resident in the Cape region, this well-marked form has not been found there by ornithologists during the past twenty years (cf. Grinnell, Univ. of Cal. Publications in Zoöl., **32**, 1928, p. 118). Lately, however, Mr. Peters, in carefully identifying the long series of *C. sulcirostris* in the Museum of Comparative Zoölogy has found that specimens from the west coast of Mexico — Sinaloa, Colima, Tehuantepec etc., undoubtedly belong with *pallidula*.

CAPITONIDAE

Tricholaema diadematum mustum Friedmann

Tricholaema diadematum mustum Friedmann, Proc. New Eng. Zoöl. Club, **11**, 1929, p. 35 .

Type.— No. 56,470, ♂; Kenya Colony, Guaso Nyiro River; 15 July, 1909; Glover M. Allen.

Bucco calvus Lafresnaye

now Gymnobucco calvus calvus (Lafresnaye)

Bucco calvus Lafresnaye, Rev. Zoöl., 1841, p. 241.

Type.— No. 76,270, Lafresnaye Collection, no. 1,647.

Lafresnaye wrote a long label for this example, which dealt wholly with synonymy etc., and contained no word as to the history of the specimen.

Pogoniulus bilineatus conciliator Friedmann

Pogoniulus bilineatus conciliator Friedmann, Proc. New Eng. Zoöl. Club, **11**, 1929, p. 36.

Type.— No. 237,561, ♀; Tanganyika Territory, Nyange, Uluguru Mountains; 11 October, 1926; Arthur Loveridge.

Cyanops davisoni laurentii Wells

now Cyanops asiatica laurentii (Wells)

Cyanops davisoni laurentii Wells, Bull. B. O. C., **43**, 1923, p. 174.

Cotype.— No. 130,725, ♂; Yunnan, 150 miles south of Yunnanfu; 8 May, 1922; La Touche Collection.

Two cotypes were designated by Wells when he described the subspecies, the other is in the British Museum.

† Bucco rubritorques Peale

= Cyanops henricii henricii (Temminck)

Bucco rubritorques Peale, U. S. Expl. Exped., 1848, p. 133.

Cotype.— No. 75,768, from U. S. Expl. Exped.

Cotype.— No. 75,769, from U. S. Expl. Exped.

Bucco henricii Temminck, Pl. Col., **3**, 1831, pl. 524.

Peale says "five specimens of this bird were obtained at Singapore."

† Barbion sulphuratus Lafresnaye

= Trachyphonus vaillantii vaillantii Ranzani

Barbion sulphuratus Lafresnaye, Mag. Zoöl., 1836, cl. 2, 60.

Type.— No. 84,336; Lafresnaye Collection, no. 1,657; "Verreaux, étiq. Pays des Masilikats."

Trachyphonus vaillantii Ranzani, Elem. Zoöl., **3**, 1821, pt. 2, p. 159.

Trachyphonus purpuratus J. and E. Verreaux.

now Trachylaemus purpuratus purpuratus (J. and E. Verreaux)

Trachyphonus purpuratus (*sic*) J. and E. Verreaux. Rev. and Mag. Zoöl., 1851, p. 260.

Cotype.— No. 84,332, ♂; Lafresnaye Collection, no. 1,658.

A label for this specimen signed V. reads — "*Trachyphonus purpuratus* Verr. ♂ Gabon."

In their description of the species the brothers Verreaux say that they had two specimens, one fully adult, marked as a male, which they describe at length, and a second which differed slightly from it. Our example agrees exactly with their long account of the adult male. The other example was not in the Lafresnaye Collection.

† Capito aurantiiventris Ridgway

= Capito niger amazonicus (Deville and Des Murs)

Capito aurantiiventris Ridgway, Proc. Biol. Soc. Washington, **25**, 1912, p. 87.

Type.— No. 7,601; Brazil; Thayer Exped.; collected by Newton Dexter.

Capito niger amazonicus Deville and Des Murs, Rev. and Mag. Zoöl., 1849, p. 171.

Capito auratus bolivianus Ridgway

now Capito niger bolivianus Ridgway

Capito auratus bolivianus Ridgway, Proc. Biol. Soc. Washington, **25**, 1912, p. 87.

Type.— No. 47,379; "Bolivia, Rio Beni."

The type, a flat skin, was taken from an Indian necklace by Dr. Thomas Barbour.

MICROPOGON BOURCIERII Lafresnaye

now CAPITO BOURCIERII BOURCIERII (Lafresnaye), male

Micropogon Bourcierii Lafresnaye, Rev. Zoöl., 1845, p. 179.

Type.— No. 76,268; Lafresnaye Collection, no. 1,704; "Bogota."

† MICROPOGON HARTLAUBII Lafresnaye

= CAPITO BOURCIERII BOUCIERII (Lafresnaye), female

Micropogon Hartlaubii Lafresnaye, Rev. Zoöl., 1845, p. 180.

Type.— No. 76,269; Lafresnaye Collection, no. 1,708; "Bogota."

Micropogon Bourcierii Lafresnaye, Rev. Zoöl., 1845, p. 179.

EUBUCCO BOURCIERI ANOMALUS Griscom

now CAPITO BOURCIERII ANOMALUS (Griscom)

Eubucco bourcieri anomalus Griscom, Bull. Mus. Comp. Zoöl., **69**, 1929, p. 163.

Type.— No. 140,512, ♂; Eastern Panama, Cana; 1 August, 1928; Rex R. Benson.

RHAMPHASTIDAE

PTEROGLOSSUS ALBIVITTA Boissonneau

now AULACORHYNCHUS ALBIVITTA ALBIVITTA (Boissonneau)

Pteroglossus albivitta Boissonneau, Rev. Zoöl., 1840, p. 70.

Type.— No. 76,092; Lafresnaye Collection, no. 1,195; "St$^{a.}$ fé de Bogota."

AULACORHAMPHUS PETAX Bangs

= AULACORHYNCHUS ALBIVITTA PHÆOLAEMUS (Gould)

Aulacorhamphus petax Bangs, Proc. Biol. Soc. Washington, **21**, 1908, p. 158.

Type.— No. 120,570, ♂; Colombia, San Antonio, Rio Cali; 5 November, 1907; M. G. Palmer.

Aulacorhamphus phæolaemus Gould, Ann. Mag. N. H., **14**, 1874, p. 184.

PTEROGLOSSUS CAERULEICINCTUS Lafresnaye

now AULACORHYNCHUS CAERULEICINCTUS (Lafresnaye)

Pteroglossus caeruleicinctus Lafresnaye, in d'Orbigny, Dict. Univ., **2**, 1843 (–1841), p. 54.

Type.— No. 76,175; Lafresnaye Collection, no. 1,200; no data.

The label for this specimen reads only "*aulacorhynchus caerulei-*

cinctus nob." Besides the type there is a second specimen, no. 1,201 which is not a cotype. Its label reads as follows — "affinis Pterog. haematopygus Gould Proceed. 1834, p. 147 sed differt rostri colore et cingulo cyanea."

Aulacorhamphus lautus Bangs

now Aulacorhynchus lautus (Bangs)

Aulacorhamphus lautus Bangs, Proc. Biol. Soc. Washington, **12**, 1898, p. 173.

Type.— No. 105,789, ♂; Colombia, Santa Marta Mountains, San Miguel; 6 June, 1898; W. W. Brown.

GALBULIDAE

Galbula ruficauda pallens Bangs

Galbula ruficauda pallens Bangs, Proc. Biol. Soc. Washington, **12**, 1898, p. 133.

Type.— No. 105,073, ♂; Colombia, Santa Marta; 27 December, 1897; W. W. Brown.

Galbula surinamensis F. P. and A. P. Penard

Galbula surinamensis F. P. and A. P. Penard, Vogels van Guyana, **1**, 1908, p. 576.

Type.— No. 249,307, ♂; Surinam, Lelydorp; A. P. Penard.

The type of this species, described by his brothers, was presented to the Museum of Comparative Zoölogy by T. E. Penard. Judged by a single individual, it seems quite distinct from *G. albirostris* Latham. As the Penards say in the original description, it has a larger and wholly yellowish bill (lacking the black tip to the upper mandible); it is more coppery green above, paler rufous below, and has a smaller white throat patch.

Jacamerops aurea penardi Bangs and Barbour

Jacamerops aurea penardi Bangs and Barbour, Bull. Mus. Comp. Zoöl., **65**, 1922, p. 200.

Type.— No. 116,609, ♀; Costa Rica, Carrillo; 19 November, 1898; C. F. Underwood.

BUCCONIDAE

† Tamatia gularis d'Orbigny and Lafresnaye

= Hypnelus ruficollis ruficollis (Wagler)

Tamatia gularis d'Orbigny and Lafresnaye, Rev. Zoöl., 1838, p. 166.

Type.— No. 76,272; Lafresnaye Collection, no. 1,727; "Carthagene, de Candé."

Capito ruficollis Wagler, Isis, 1829, p. 658.

Monasa mystacalis Lafresnaye

now Malacoptila mystacalis (Lafresnaye)

Monasa mystacalis Lafresnaye, Rev. et Mag. Zoöl., 1850, p. 215.

Type.— No. 76,273; Lafresnaye Collection, no. 1,739; "Colombie, Parzudaki."

The type locality of this species has been fixed by Chapman as Valparaiso, Santa Marta Mountains, Colombia.

† Monasa axillaris Lafresnaye

= Monasa flavirostris Strickland

Monasa axillaris Lafresnaye, Rev. et Mag. Zoöl., 1850, p. 216.

Type.— No. 76,271; Lafresnaye Collection, no. 1,750; "rio negro."

Monasa flavirostris Strickland, Contr. Orn., 1850, p. 47, pl. 48.

For his specimen Lafresnaye wrote a label as follows — "*Monasa flavirostris* Strickland, jardine contrib. to ornithology, 1850. *Monasa axillaris* b. à epaulettes blanches, nob. rev. zoöl., Avril, 1850, p. 216, rio negro (Perou, Strickland) les deux noms donnés à la même date."

PICIDAE

Colaptes auratus luteus Bangs

Colaptes auratus luteus Bangs, Auk, **15**, 1898, p. 177.

Type.— No. 100,830, ♂; Massachusetts, Watertown; 2 May, 1879; E. A. and O. Bangs.

Colaptes mexicanoides Lafresnaye

now Colaptes mexicanoides mexicanoides (Lafresnaye)

Colaptes mexicanoides Lafresnaye, Rev. Zoöl., 1844, p. 42.

Cotype.— No. 76,213, ♂; Lafresnaye Collection, no. 1,599; "mexique."

Cotype.— No. 76,214, ♀; Lafresnaye Collection, no. 1,600; "mexique."

Lafresnaye received his two specimens from Parzudaki. They probably came from Guatemala, as they are exactly like skins from that country, with which I have compared them.

Colaptes pitius cachinnans Wetmore and Peters

Colaptes pitius cachinnans Wetmore and Peters, Proc. Biol. Soc. Washington, **35**, 1922, p. 43.

Type.— No. 85,293, ♀; Argentina, Bariloche; 17 February, 1921; J. L. Peters.

† Gecinus canus jacobsii La Touche

= Picus canus setschuanus Hesse

Gecinus canus jacobsii La Touche, Bull. B. O. C., **41**, 1919, p. 50.

Cotype.— No. 131,142, ♂; Hupeh, Changyanghsien; 22 November, 1918; La Touche Collection.

Cotype.— No. 131,143, ♀; Hupeh, Changyanghsien; 26 September, 1918; La Touche Collection.

Picus canus setschuanus Hesse, Orn. Monatsb., 1911, p. 193.

Peters and I (Bull. Mus. Comp. Zoöl., **68**, 1928, p. 332) at one time were inclined to refer all middle Chinese green woodpeckers to *gunieri* We have again gone over our large amount of material very carefully, and now recognize *setschuanus*, in spite of the fact that its characters are not wholly constant.

All birds taken by Zappey in the lowlands of Hupeh are *guerini*, but most of those from the mountains are somewhat darker in color, as are also most of the skins from Szetchuan. In any event it is not possible to distinguish birds from the mountains of Hupeh and Szetchuan, and *jacobii* falls as a synonym of *setschuanus*.

Picus canus yunnanensis La Touche

Picus canus yunnanensis La Touche, Bull. B. O. C., **43**, 1922, p. 44.

Cotype.— No. 131,129, ♂; Yunnan, Milati; 20 January, 1921; La Touche Collection.

Cotype.— No. 131,130, ♀; Yunnan, Milati; 15 January, 1921; La Touche Collection.

Chloronerpes simplex allophyeus Bangs

now Piculus simplex allophyeus (Bangs)

Chloronerpes simplex allophyeus Bangs, Bull. Mus. Comp. Zoöl., **39**, 1903, p. 145.

Type.— No. 110,349, ♂; Honduras, Yaruca; 11 February, 1902; W. W. Brown.

† Chloronerpes rubiginosus roraimae T. E. Penard

= Piculus rubiginosus guianae (Hellmayr)

Chloronerpes rubiginosus roraimae T. E. Penard, Proc. New Eng. Zoöl. Club, **7**, 1919, p. 29.

Type.— No. 82,134, ♀; British Guiana, Roraima; 27 December, 1883; H. Whitely.

Chloronerpes rubiginosus guianae Hellmayr, Verh. Orn. Ges. Bayern, **13**, 1918, p. 314.

Chloronerpes yucatanensis alleni Bangs

now Piculus rubiginosus alleni (Bangs)

Chloronerpes yucatanensis alleni Bangs, Proc. New Eng. Zoöl. Club, **3**, 1902, p. 83.

Type.— No. 106,943, ♂; Colombia, Santa Marta Mountains, San Sebastian; 30 July, 1899; W. W. Brown.

Picus yucatanensis Cabot

now Piculus rubiginosus yucatanensis (Cabot)

Picus yucatanensis Cabot, Proc. Bost. Soc. N. H., **1**, 1844, p. 164; Bost. Jour. N. H., **5**, 1845, p. 92.

Type.— No. 74,745, ♂; Yucatan, Road from Chemax to Yalahao; March, 1842; S. Cabot.

At the time I wrote an account of the Cabot Types of Yucatan

Birds (Auk, **32**, 1915, p. 168) this type could not be found. Soon afterwards, however, it turned up, out of place of course, but fortunately with the Cabot tag and number intact.

Chrysoptilus atricollis lymani Bangs and Noble

Chrysoptilus atricollis lymani Bangs and Noble, Proc. New Eng. Zoöl. Club, **6**, 1918, p. 85.

Type.— No. 80,095, ♂; Peru, Huancabamba; 17 August, 1916; G. K. Noble.

Chrysoptilus punctigula lucescens Griscom

Chrysoptilus punctigula lucescens Griscom, Bull. Mus. Comp. Zoöl., **69**, 1929, p. 165.

Type.— No. 140,590, ♂; Eastern Panama, El Real; 18 January, 1928; Rex R. Benson.

Picus torquatus Wilson

now Asyndesmus lewisi Riley

Picus torquatus Wilson, Am. Orn., **3**, 1811, p. 31, pl. 20, fig. 3; from Montana, about lat. 46° N. (not *Picus torquatus* Boddaert, 1783).

Asyndesmus lewisi Riley, Proc. Biol. Soc. Washington, **18**, 1905, p. 225 (new name to replace *Picus torquatus* Wilson preoccupied).

Type.— No. 67,854; from the old Peale Museum.

Thought by Dr. Faxon to be in all probability the type.

Centurus superciliaris murceus Bangs

Centurus superciliaris murceus Bangs, Proc. Biol. Soc. Washington, **23**, 1910, p. 173.

Type.— No. 113,260, ♂; Isle of Pines, near Cuba; 2 May, 1904; W. R. Zappey.

Picus dubius Cabot

now Centurus dubius dubius (Cabot)

Picus dubius Cabot, Proc. Bost. Soc. N. H., **1**, 1844, p. 164; Bost. Journ. N. H., **5**, 1845, p. 91.

Type.— No. 71,785, ♂; Yucatan, Uxmal; November, 1841; S. Cabot.

Melanerpes seductus Bangs

now Centurus seductus (Bangs)

Melanerpes seductus Bangs, Auk, **18**, 1901, p. 26.

Type.— No. 104,892, ♂; San Miguel Island, Pearl Islands, Bay of Panama; 27 April, 1900; W. W. Brown.

† Centurus wagleri sanctæ-martæ Bangs

= Centurus rubricapillus rubricapillus Cabanis

Centurus wagleri sanctæ-martæ Bangs, Proc. Biol. Soc. Washington, **12**, 1898, p. 134.

Type.— No. 105,103, ♂; Colombia, Santa Marta; 8 February, 1898; W. W. Brown.

Centurus rubricapillus Cabanis, J. f. O., **10**, 1862, p. 328.

Dryobates pernyii innixus Bangs and Peters

Dryobates pernyii innixus Bangs and Peters, Bull. Mus. Comp. Zoöl., **68**, 1928, p. 334.

Type.— No. 52,287, ♂; Hupeh, Changyanghsien; 24 January, 1909; W. R. Zappey.

Dryobates villosus piger G. M. Allen

Dryobates villosus piger G. M. Allen, Auk, **21**, 1905, p. 124.

Type.— No. 40,207, ♂; Bahamas, Great Bahama; 17 July, 1904; G. M. Allen.

Dendrocopus villosus extimus Bangs

now Dryobates villosus extimus (Bangs)

Dendrocopus villosus extimus Bangs, Proc. New Eng. Zoöl. Club, **3**, 1902, p. 33.

Type.— No. 108,507, ♂; Panama, Boquete; 18 April, 1901; W. W. Brown.

Picus parvus Cabot

now Dryobates scalaris parvus (Cabot)

Picus parvus Cabot, Proc. Bost. Soc. N. H., **1**, 1844, p. 164; Bost. Journ. N. H., **5**, 1845, p. 92.

Type.— No. 88,808, ♂; Yucatan, Ticul [= Tical]; December, 1841; S. Cabot.

This important type could not be found at the time I wrote an account of Cabot's Yucatan types. Long afterwards it turned up in a case of mounted Yucatan birds that Dr. Cabot had mounted for himself and that had remained ever since in his family.

Iyngipicus pygmaeus clementii La Touche

now Dryobates semicoronatus clementii La Touche

Iyngipicus pygmaeus clementii La Touche, Bull. B. O. C., **40**, 1919, p. 51.

Cotype.— No. 131,063, ♂; Hupeh, Changyanghsien; 6 January, 1919; La Touche Collection.

Cotype.— No. 131,064, ♀; Hupeh, Changyanghsien; 12 September, 1918; La Touche Collection.

The characters of this form, which occupies a wide area in central and eastern China, were first pointed out by Hargitt in Catalogue Birds British Museum, **18**, but the bird did not receive a name until La Touche gave it the above. *D. s. scintilliceps*, the next northern form, is intermediate in characters between the still more northern *doerriesi* and *clementii*.

Dryobates pygmaeus obscurus La Touche

now Dryobates semicoronatus obscurus La Touche

Dryobates pygmaeus obscurus La Touche, Bull. B. O. C., **42**, 1921, p. 14.

Type.— No. 131,054, ♀; Yunnan, Hokow; 24 May, 1921; La Touche Collection.

† Dryobates pygmaeus permixtus La Touche

= Dryobates semicoronatus omissa Rothschild

Dryobates pygmaeus permixtus La Touche, Bull. B. O. C., **43**, 1922, p. 44.

Cotype.— No. 131,200, ♂; Yunnan, Milati; 21 January, 1921; La Touche Collection.

Cotype.— No. 131,056, ♀; Yunnan, Yunnan Fu; 31 May, 1921; La Touche Collection.

Dryobates pygmaeus omissa Rothschild, Bull. B. O. C., **43**, 1922, p. 10.

Picoides americanus bacatus Bangs

now Picoides tridactylus bacatus Bangs

Picoides americanus bacatus Bangs, Auk, **17**, 1900, p. 136.

Type.— No. 100,802, ♂; Maine, Bangor; 25 March, 1884; E. S. Bowler.

In the Auk (**17**, 1900, pp. 126–142) I wrote a review of the American three-toed woodpeckers in which I named the small form of eastern North America, *bacatus*. In 1914 Ridgway in the Birds of North and Middle America did not accept my name, but used *americanus* Brehm (Handb. Vögel Deutschl., 1831, p. 195). I have gone into the question carefully again, and refuse to change my previous opinions, except that in one point I was wrong. I called Brehm's name *americanus*, a *nomen nudum*. Brehm did give one word of description "grössere" (as compared with European forms). The bird I name *P. a. bacatus* is considerably smaller than the European *P. tridactylus* and closely related forms, and Brehm's name, therefore, cannot be applied to it, as was done by Ridgway. The only North American three-toed woodpecker that is distinctly larger than the European is *P. arcticus* for which I for one refuse to use Brehm's name.

Dr. Hartert tells me (*in litt.*) that there are no North American specimens of *Picoides* in the Brehm Collection. Therefore, Brehm's unrecognizable diagnosis cannot be backed up by a type specimen.

As I read Brehm again, it seems to me quite certain that he gave the name only to something that he thought occurred in America, but about which he knew nothing. It seems to me his name goes out of consideration under Opinion 2 of the International Commission of Zoölogical Nomenclature. Some years ago Dr. Joseph Grinnell (Univ. Calif. Pub. Zoöl., **5**, 1909, p. 217) declared that he shared with me the opinion that *americanus* of Brehm cannot stand as a formal name for any subspecies. I can see no reason at all for calling the small form of eastern North America anything but *bacatus*.

Without the slightest hesitation I list all black and white-backed three-toed woodpeckers as subspecies of *Picoides tridactylus* (Linné).

† Picoides americanus labradorius Bangs

= Picoides tridactylus bacatus Bangs

Picoides americanus labradorius Bangs, Auk, **17**, 1900, p. 138.

Type.— No. 101,524, ♂; Labrador, Okak; June, 1895; C. Schmitt.

Pocoides americanus bacatus Bangs, Auk, **17**, 1900, p. 136.

The Labrador bird, while a trifle larger and perhaps slightly darker than *bacatus*, is too close to that form to deserve to be recognized by name. Lately Mr. O. L. Austin, Jr. in the course of work on his Labrador collections, has been over our large series and fails to find sufficient reason to recognize *labradorius*.

Picoides arcticus tenuirostris Bangs

Picoides arcticus tenuirostris Bangs, Auk, **17**, 1900, p. 131.

Type.— No. 219,576, ♂; Oregon, Fort Klamath; 13 December, 1886; J. C. Merrill.

This form appears to me to be well marked; its very slender bill distinguishing it from true *arcticus* of eastern boreal America, and the northern Rocky Mountain region.

Veniliornis neglectus Bangs

now Veniliornis kirkii neglectus Bangs

Veniliornis neglectus Bangs, Proc. New Eng. Zoöl. Club, **2**, 1901, p. 99.

Type.— No. 107,802, ♀; Panama, Divala; 9 November, 1900; W. W. Brown.

Xiphidiopicus percussus insulae-pinorum Bangs

Xiphidiopicus percussus insulae-pinorum Bangs, Proc. Biol. Soc. Washington, **23**, 1910, p. 173.

Type.— No. 113,480, ♂; Isle of Pines, near Cuba, Santa Fé, 18 April, 1904; W. R. Zappey.

† Campophilus guatemalensis buxans Bangs

= Campephilus guatemalensis guatemalensis (Hartlaub)

Campophilus guatemalensis buxans Bangs, Auk, **18**, 1901, p. 306.

Type.— No. 107,803, ♂; Panama, Divala; 26 November, 1900; W. W. Brown.

Picus guatemalensis Hartlaub, Rev. Zoöl., 1844, p. 214.

† Picus jubatus Lafresnaye

= Ipocrantor magellanicus (King), ♀,

Picus jubatus Lafresnaye, Rev. Zoöl., 1841, p. 242.

Type.— No. 75,308; Lafresnaye Collection, no. 1,354 (neither locality nor the source of the specimen given on Lafresnaye's written label).

Picus magellanicus King, Zoöl. Journ., **3**, 1827, p. 430.

Ceophloeus lineatus improcerus Bangs and Penard

Ceophloeus lineatus improcerus Bangs and Penard, Bull. Mus. Comp. Zoöl., **62**, 1918, p. 58.

Type.— No. 71,865, ♂; a Bahia "trade skin."

Ceophloeus erythrops fulcitus Peters

Ceophloeus erythrops fulcitus Peters, Occ. Papers Bost. Soc. N. H., **5**, 1926, p. 195.

Type.— No. 99,303, ♂; Argentina, Chaco, Resistencia; 19 July, 1915; J. Mogensen.

Ceophloeus pileatus abieticola Bangs

now Phlœotomus pileatus abieticola (Bangs)

Ceophloeus pileatus abieticola Bangs, Auk, **15**, 1898, p. 176.

Type.— No. 103,008, ♀; Maine, Greenville; 7 November, 1895; C. H. Goldthwaite.

Phlœotomus pileatus picinus Bangs

Phlœotomus pileatus picinus Bangs, Proc. New Eng. Zoöl. Club, **4**, 1910, p. 79.

Type.— No. 104,516, ♀; British Columbia, Sumas; 1 April, 1897; A. C. Brooks.

Picumnus squamulatus Lafresnaye

now Picumnus squamulatus squamulatus (Lafresnaye)

Picumnus squamulatus Lafresnaye, Rev. Zoöl., 1854, p. 208.

Type.— No. 76,224, Lafresnaye Collection, no. 1,628; "Colombie."

In Verreaux's catalogue of the Lafresnaye Collection, no. 1,629 is entered as *Picumnus granadensis* and no. 1,627 as *Picumnus squamulatus*. This is an inadvertence in cataloguing: the numbers should be exactly reversed.

Picumnus granadensis Lafresnaye

now Picumnus granadensis granadensis Lafresnaye

Picumnus granadensis Lafresnaye, Rev. Zoöl., 1847, p. 78.

Cotype.— No. 76,221, Lafresnaye Collection, no. 1,627; "Caly [= Cali], Nlle Grenade."

Lafresnaye described this species from specimens in the Delattre Collection, which was bought by Dr. Wilson in Paris, and was sub-

mitted to Lafresnaye to have him describe the new or interesting matter it contained, before shipment to America. The collection is now in the Academy of Natural Sciences of Philadelphia to which institution Dr. Wilson presented it.

Lafresnaye mentioned that he examined two specimens. Dr. Stone found two specimens in the Delattre Collection and in his paper on the types in the collection of the Academy (Proc. Acad. Nat. Sci., Philadelphia, 1899, p. 52) lists them both as cotypes. One of these is from "New Grenada" (the type locality M. Cali not expressed); the other is without locality. The specimen in the Lafresnaye Collection is, according to Lafresnaye, from the type locality, Cali, and bears every evidence of being one of the two mentioned by Lafresnaye. Probably Dr. Wilson gave this bird, as well as some others I find in the collection with much the same history, to Lafresnaye. The specimen without locality would appear to have no claim to being a type.

Dr. Stone to whom I submitted these facts not only agrees with me but adds (*in litt.*) that he would now give first place to the specimen in the Lafresnaye Collection.

† Picumnus canus Bangs

= Picumnus granadensis granadensis Lafresnaye

Picumnus canus Bangs, Proc. Biol. Soc. Washington, **23**, 1910, p. 72.

Type.— No. 123,434, ♀; Colombia, Naranjito, Rio Dagua; 20 June; M. G. Palmer.

Picumnus granadensis Lafresnaye, Rev. Zoöl., 1847, p. 78.

At the time I described *canus,* I in some way was possessed with the notion that *granadensis* Lafresnaye was a form of *olivaceus,* and that my bird was very different. Soon afterwards I discovered my mistake.

Picumnus dimotus Bangs

now Picumnus olivaceus dimotus Bangs

Picumnus dimotus Bangs, Bull. Mus. Comp. Zoöl., **39**, 1903, p. 146.

Type.— No. 110,328, ♂; Honduras, Ceiba; 21 January, 1902; W. W. Brown.

† Sasia lacrymosa Lafresnaye

= Sasia ochracea ochracea Hodgson

Sasia lacrymosa Lafresnaye, Rev. et Mag. Zoöl., 1854, p. 218.

Type.— No. 88,775; Lafresnaye Collection, no. 1,710; "Hymalaya."

Sasia ochracea Hodgson, Jour. As. Soc. Bengal, **5**, 1836, p. 777.

Lafresnaye's type is in excellent condition, and although without definite data, undoubtedly belongs with the typical form.

EURYLAEMIDAE

Serilophus lunatus elizabethæ La Touche

Serilophus lunatus elizabethæ La Touche, Bull. B. O. C., **42**, 1921, p. 14.

Cotype.— No. 130,682, ♂; Yunnan, Hokow; 22 March, 1921; La Touche Collection.

Cotype.— No. 130,683, ♀; Yunnan, Hokow; 29 March, 1921; La Touche Collection.

Serilophus steerei Sharpe

now Sarcophanops steerei (Sharpe)

Serilophus steerei Sharpe, Nature, **14**, 1876, p. 297.

Cotype.— No. 86,884, ♀; Philippine Islands, Basilan; Steere Collection.

This specimen, kindly presented to us by the authorities of the Museum of the University of Michigan, was marked "Type" on its labels by both Sharpe and (I think) Steere. As, however, no holotype was designated, every one of the original specimens collected by Steere is a cotype.

PTEROPTOCHIDAE

(The order followed here is that of Hellmayr, Catalogue of Birds of the Americas, pt. 3, 1924).

† Pteroptochos rubecula hylonympha Peters

= Scelorchilus rubecula (Kittlitz)

Pteroptochos rubecula hylonympha, Peters Proc. New Eng. Zoöl. Club, **8**, 1923, p. 45.

Type.— No. 85,317, ♂; Argentina, Bariloche; 5 February, 1921; J. L. Peters.

Pteroptochos rubecula Kittlitz, Mem. Sci. St. Petersb., 1830, p. 179, pl. 2.

† Merulaxis fuscoides Lafresnaye

= Scytalopus fuscus Gould

Merulaxis fuscoides Lafresnaye, Contrib. Ornith., **4**, 1851, p. 149.

Type.— No. 84,294; Lafresnaye Collection, no. 4,848; "Chili."

Scytalopus fuscus Gould, P. Z. S., 1836 (= Feb., 1837), p. 89.

Scytalopus latebricola Bangs

now Scytalopus latebricola latebricola Bangs

Scytalopus latebricola Bangs, Proc. Biol. Soc. Washington, **13**, 1899, p. 101.

Type.— No. 106,208, ♀ ; Colombia, Santa Marta Mountains, Paramo de Chiruqua; 10 March, 1899; W. W. Brown.

Merulaxis griseicollis Lafresnaye

now Scytalopus griseicollis griseicollis (Lafresnaye)

Merulaxis griseicollis Lafresnaye, Rev. Zoöl., 1840, p. 103.

Type.— No. 76,330; Lafresnaye Collection, no. 4,851; Bogota.

† Merulaxis squamiger Lafresnaye

= Scytalopus griseicollis griseicollis (Lafresnaye), juvenile plumage

Merulaxis squamiger Lafresnaye, Rev. Zoöl., 1840, p. 103.

Type.— No. 76,331; Lafresnaye Collection. no. 4,855; Bogotà.

Merulaxis griseicollis Lafresnaye, Rev. Zoöl., 1840, p. 103.

Merulaxis senilis Lafresnaye

now Myornis senilis (Lafresnaye)

Merulaxis senilis Lafresnaye, Rev. Zoöl., 1840, p. 103.

Type.— No. 76,327; Lafresnaye Collection, no. 4,852; Bogotà.

† Merulaxis analis Lafresnaye

= Triptorhinus paradoxus (Kittlitz)

Merulaxis analis Lafresnaye, Rev. Zoöl., 1840, p. 104.

Type.— No. 76,333; Lafresnaye Collection, no. 4,853; "du Paraguay ou du Chile."

Troglodytes paradoxus Kittlitz, Mem. Ac. Sci. St. Petersb., **2**, 1830, p. 184, pl. 5.

MERULAXIS ORTHONYX Lafresnaye

now ACROPTERNIS ORTHONYX ORTHONYX (Lafresnaye)

Merulaxis orthonyx Lafresnaye, Rev. Zoöl., 1843, p. 131.

Type.— No. 76,326; Lafresnaye Collection, no. 4,860; "Colombie" (= Bogotá).

FORMICARIIDAE

(The order used follows Hellmayr, op. cit.)

ANABATES NIGROPECTUS Lafresnaye

now BIATAS NIGROPECTUS (Lafresnaye)

Anabates nigro-pectus Lafresnaye, Rev. et Mag. Zoöl., 1850, p. 107, pl. 1, fig. 3.

Type.— No. 76,747; Lafresnaye Collection, no. 4,924; "Am. Merid." (Rio de Janeiro, suggested by Hellmayr).

Lafresnaye had a second specimen, no. 4,925, that differs quite a little from the type, and did not play any part in the original description.

† THAMNOPHILUS DOLIATUS CATUS Bangs

= THAMNOPHILUS DOLIATUS FRATERCULUS (Berlepsch and Hartert)

Thamnophilus doliatus catus Bangs, Proc. Biol. Soc. Washington, **24**, 1911, p. 189.

Cotype.— No. 102,712, ♂; Margarita Island; 14 July, 1901; A. H. Clark.

Cotype.— No. 102,715, ♀; Margarita Island; 10 July, 1901; A. H. Clark.

Thamnophilus doliatus fraterculus Berlepsch and Hartert, Nov. Zoöl., **9**, 1902, p. 70.

THAMNOPHILUS ALBICANS Lafresnaye

now THAMNOPHILUS DOLIATUS ALBICANS Lafresnaye

Thamnophilus albicans Lafresnaye, Rev. Zoöl., 1844, p. 82.

Type.— No. 76,749; Lafresnaye Collection, no. 4,886; "Colombie."

Of the three specimens in the Lafresnaye Collection, all called by Verreaux *Thamnophilus radiatus*, only the one listed above figured in the description of the form.

Thamnophilus multistriatus Lafresnaye

Thamnophilus multistriatus Lafresnaye, Rev. Zoöl., 1844, p. 82.

Type.— No. 76,753; Lafresnaye Collection, no. 4,884; "Colombie." Besides the type the Lafresnaye Collection contains another male and a female. The male differs somewhat from the type, and, therefore, from the original description, and the female was supposed by Lafresnaye to belong to a different species.

Thamnophilus tenuepunctatus Lafresnaye

now Thamnophilus tenuepunctatus tenuepunctatus Lafresnaye

Thamnophilus tenuepunctatus Lafresnaye, Rev. et Mag. Zoöl., 1853, p. 339.

Type.— No. 76,751; Lafresnaye Collection, no. 4,893 bis., "Anolaima, Nouv. Grenade."

Thamnophilus gorgonæ Thayer and Bangs

now Thamnophilus punctatus gorgonæ Thayer and Bangs

Thamnophilus gorgonæ Thayer and Bangs, Bull. Mus. Comp. Zoöl., **46**, 1905, p. 95.

Type.— No. 114,005, ♀; Gorgona Island, off west coast of Colombia; 1 July, 1904; W. W. Brown.

Myrmotherula brachyura ignota Griscom

Myrmotherula brachyura ignota Griscom, Bull. Mus. Comp. Zoöl., **69**, 1929, p. 167.

Type.— No. 87,224, ♂; Eastern Panama, Rio Jesusito; 7 April, 1922; Barbour, Brooks and Underwood.

Synallaxis bitorquata d'Orbigny and Lafresnaye

now Melanopareia torquata bitorquata (d'Orbigny and Lafresnaye)

Synallaxis bitorquata d'Orbigny and Lafresnaye, Mag. Zoöl., 1837, p. 24.

Type.— No. 77,263; Lafresnaye Collection, no. 2,444; "Bolivie, d'Orb."

Formicivora alticincta Bangs

now Neorhopias grisea alticincta (Bangs)

Formicivora alticincta Bangs, Proc. New Eng. Zoöl. Club, **3**, 1902, p. 71.

Type.— No. 104,940, ♂; San Miguel Island, Pearl Islands, Bay of Panama; 30 April, 1900; W. W. Brown.

Cercomacra crepera Bangs

now Cercomacra tyrannina crepera Bangs

Cercomacra crepera Bangs, Auk, **18**, 1901, p. 365.

Type.— No. 107,913, ♀ ? [=♂]; Panama, Divala; 24 November, 1900; W. W. Brown.

† Myrmelastes ceterus Bangs

= Gymnocichla nudiceps nudiceps (Cassin), young male with feathered (not bare) crown

Myrmelastes ceterus Bangs, Proc. New Eng. Zoöl. Club, **2**, 1900, p. 25.

Type.— No. 107,323, ♂; Panama, Loma del Leon; 30 March, 1900; W. W. Brown.

Myiothera nudiceps Cassin, Proc. Acad. Nat. Sci. Phila., 1850, p. 106, pl. 6.

Gymnocichla nudiceps erratilis Bangs

Gymnocichla nudiceps erratilis Bangs, Auk, **24**, 1907, p. 297.

Cotype.— No. 118,991 ♂; Costa Rica, Boruca; 22 May, 1906; C. F. Underwood.

Cotype.— No. 118,990, ♀; Costa Rica, Boruca; 11 June, 1906; C. F. Underwood.

Thamnophilus immaculatus Lafresnaye

now Myrmeciza immaculata immaculata (Lafresnaye)

Thamnophilus immaculatus Lafresnaye, Rev. Zoöl., 1845, p. 340.

Cotype.— No. 76,756; Lafresnaye Collection, no. 4,909; "Bogotá."

Cotype.— No. 76,757; Lafresnaye Collection, no. 4,910; "Bogotá."

Cotype.— No. 76,758 [♀]; Lafresnaye Collection, no. 4,911; "Bogotà."

For these three specimens Lafresnaye wrote labels all alike. Two other examples in the collection, however, are not cotypes.

Hypocnemis naevioides capnitis Bangs

now Hylophylax naevioides capnitis (Bangs)

Hypocnemis naevioides capnitis Bangs, Proc. Biol. Soc. Washington, **19**, 1906, p. 107.

Type.— No. 117,048, ♂; Costa Rica, Miravalles; 16 October, 1895; C. F. Underwood.

Phaenostictus mcleannani chocoanus Bangs and Barbour

Phaenostictus mcleannani chocoanus Bangs and Barbour, Bull. Mus. Comp. Zoöl., **65**, 1922, p. 208.

Type.— No. 87,352, ♂; Eastern Panama, Mount Sapo; 20 April, 1922; Barbour, Brooks and Underwood.

† Grallaricula vegeta Bangs

= Grallaricula flavirostris costaricensis (Lawrence)

Grallaricula vegeta Bangs, Proc. New Eng. Zoöl. Club, **3**, 1902, p. 42.

Type.— No. 108,552, ♀; Panama, Caribbean slope, Volcan de Chiriqui; 12 June, 1901; W. W. Brown.

Grallaricula costaricensis Lawrence, Ann. Lyc. Nat. Hist., N. Y., **8**, 1867, p. 346.

† Conopophaga browni Bangs

= Grallaricula ferrugineipectus (Sclater)

Conopophaga browni Bangs, Proc. Biol. Soc. Washington, **13**, 1899, p. 100.

Type.—No. 106,177, ♂; Colombia, Santa Marta Mountains, Chirua; 12 February, 1899; W. W. Brown.

Grallaria ferrugineipectus Sclater, P. Z. S., 1857, p. 129.

Grallaria nana Lafresnaye

now Grallaricula nana nana (Lafresnaye)

Grallaria nana Lafresnaye, Rev. Zoöl., 1842, p. 334.

Type.— No. 76,739; Lafresnaye Collection, no. 5,081; "Colombie."

Grallaria imperator Lafresnaye

now Grallaria varia imperator Lafresnaye

Grallaria imperator Lafresnaye, Rev. Zoöl., 1842, p. 555.

Type.— No. 76,730; Lafresnaye Collection, no. 5,061; "Prov. St. Paul."

† Grallaria monticola Lafresnaye

= Grallaria quitensis quitensis Lesson

Grallaria monticola Lafresnaye, Rev. Zoöl., 1847, p. 68.

Type.— No. 76,731; Lafresnaye Collection, no. 5,068; label — "*Grallaria monticola* N. dans la region élévée et froide des andes de la bolivie."

Grallaria quitensis Lesson, Echo du Monde Savant, 1844, no. 49, p. 848.

Our specimen which is marked in Lafresnaye's own hand as having come from his type locality, I cannot help considering a cotype. The one listed by Stone (Proc. Acad. Nat. Sci. Phil., 1899, p. 50) may also be a cotype, although it is marked as having come from Ecuador. Lafresnaye (*loc. cit.*) gives the type locality of his *G. monticola* as Bolivian Andes, and says in his remarks that Delattre found the species in Peru. He does not mention Ecuador, but does particularly mention Pasto. The species has not been found in Peru or Bolivia, but does occur in Ecuador and Colombia, and I believe that the localities Peru and Bolivia were given in error, and that probably our cotype and possibly the cotype in Philadelphia really came from the Andes above Pasto.

There is another specimen in the collection, which, judging by its label, has no claim at all to be considered a cotype.

Lafresnaye had besides a small bird (wing 86 mm.) with a small bill, slender tarsus, and much more rufous tail and sides of the face.— M. C. Z., 84,765; Lafresnaye Collection, 5,070 — for which he wrote a label as follows — "grallaria quitensis ? Lesson, grallaria de quito? Echo, 1844, p. 848." Evidently Lafresnaye thought that this bird represented *G. quitensis* and, therefore, described the large species as *G. monticola*. The larger bird is, of course, *G. quitensis*, and the smaller one belongs to the recently described, *Grallaria quitensis alticola* Todd.

GRALLARIA RUFICAPILLA Lafresnaye

now GRALLARIA RUFICAPILLA RUFICAPILLA Lafresnaye

Grallaria ruficapilla Lafresnaye, Rev. Zoöl., 1842, p. 333

Type.— No. 76,733; Lafresnaye Collection, no. 5,065; "Colombie."

GRALLARIA RUFULA Lafresnaye

now GRALLARIA RUFULA RUFULA Lafresnaye

Grallaria rufula Lafresnaye, Rev. Zoöl., 1843, p. 99.

Type.— No. 76,736; Lafresnaye Collection, no. 5,077, "Colombie."

GRALLARIA SPATIATOR Bangs

now GRALLARIA RUFULA SPATIATOR Bangs

Grallaria spatiator Bangs, Proc. Biol. Soc. Washington, **12**, 1898, p. 177.

Type.— No. 105,683, ♂; Colombia, Santa Marta Mountains, Macotama; 17 June, 1898; W. W. Brown.

FURNARIIDAE

(The order here followed is that of Hellmayr's Catalogue Birds of the Americas, pt. 4, 1925).

GEOSITTA CUNICULARIA HELLMAYRI Peters

Geositta cunicularia hellmayri Peters, Occ. Papers Bost. Soc. N. H., **5**, 1925, p. 145.

Type.— No. 85,339, ♂; Argentina, Rio Negro, Huanuluan; 25 September, 1920; J. L. Peters.

ALAUDA TENUIROSTRIS Lafresnaye

now GEOSITTA TENUIROSTRIS (Lafresnaye)

Alauda tenuirostris Lafresnaye, Mag. Zoöl., **6**, 1836, text to pls. 58 and 59.

Cotype.— No. 77,197; Lafresnaye Collection, no. 2,397; "Sica-Sica, cochabamba."

Cotype.— No. 77,198; Lafresnaye Collection, no. 2,398; "Sica-Sica, cochabamba."

I cannot agree with Hellmayr that the types of this species are in the Paris Museum. Nothing, it seems to me, could be more plain than the labels in Lafresnaye's own hand for his own specimens, with his significant "nob." on them, claiming them as the ones from which he drew his description.

Upucerthia nigro-fumosa d'Orbigny and Lafresnaye

now Cinclodes nigro-fumosa (d'Orbigny and Lafresnaye)

Upucerthia nigro-fumosa d'Orbigny and Lafresnaye, Mag. Zoöl., 1838, p. 23.

Cotype.— No. 77,199; Lafresnaye Collection, no. 2,388; "Cobija in Bolivia."

Hellmayr considers this specimen a cotype.

† Upucerthia vulgaris d'Orbigny and Lafresnaye

= Cinclodes fuscus fuscus (Vieillot)

Upucerthia vulgaris d'Orbigny and Lafresnaye, Mag. Zoöl., 1838, cl. 2, p. 22.

Cotype.— No. 77,202; Lafresnaye Collection, no. 2,382; label — "Upucerthia vulgaris, L'huppu commune nob. Santa fé, Patagonie, La Paz."

Anthus fuscus Vieillot, Nouv. Dict. Hist. Nat., 26, 1818, p. 490.

This specimen regarded by Hellmayr as a cotype is typical *fuscus*, and must, therefore, have come from either "Patagonie" or "Santa Fé," as d'Orbigny's La Paz examples are *albiventris* (Philippi and Landbeck).

Upucerthia andaecola d'Orbigny and Lafresnaye

Upucerthia andaecola d'Orbigny and Lafresnaye, Mag. Zoöl., 1838, p. 21.

Cotype.— No. 77,201; Lafresnaye Collection, no. 2,393 bis; "Sur les andes, Lapaz, Sica sica, rep. Boliv. d'Orb."

This example Hellmayr considers a cotype.

Synallaxis fuliginosa Lafresnaye

now Schizoeca fuliginosa fuliginosa (Lafresnaye)

Synallaxis fuliginosa Lafresnaye, Rev. Zoöl., 1843, p. 290.

Type.— No. 77,259; Lafresnaye Collection, no. 2,463; "Colombie."

Synallaxis albescens nesiotis Clark

Synallaxis albescens nesiotis Clark, Auk, **19**, 1902, p. 264.

Type.— No. 102,723, ♂; Margarita Island; 17 July, 1901; A. H. Clark.

Synallaxis albescens latitabunda Bangs

Synallaxis albescens latitabunda Bangs, Auk, **24**, 1907, p. 298.

Type.— No. 119,064, ♂; Costa Rica, Boruca; 31 May, 1906; C. F. Underwood.

Synallaxis brachyurus Lafresnaye

now Synallaxis brachyura brachyura Lafresnaye

Synallaxis brachyurus Lafresnaye, Rev. Zoöl., 1843, p. 290.

Type.— No. 77,256; Lafresnaye Collection, no. 2,456; "Colombie."

Synallaxis brachyura chapmani Bangs and Penard

Synallaxis brachyura chapmani Bangs and Penard, Bull. Mus. Comp. Zoöl., **63**, 1919, p. 25.

Type.— No. 124,478, ♂; western Colombia, Jimenez; 6 April, 1904; M. G. Palmer.

Synallaxis unirufus Lafresnaye

now Synallaxis unirufa unirufa Lafresnaye

Synnalaxis (sic) *unirufus* Lafresnaye, Rev. Zoöl., 1843, p. 290.

Type.— No. 84,367; Lafresnaye Collection, no. 2,461; "Colombie."

Synallaxis cinnamomeus Lafresnaye

now Synallaxis cinnamomea cinnamomea Lafresnaye

Synnalaxis (sic) *cinnamomeus* Lafresnaye, Rev. Zoöl., 1843, p. 291.

Type.— No. 77,255; Lafresnaye Collection, no. 2,475; "Colombie."

Two other examples in the collection, judged by their labels, have no claim to be considered as cotypes.

Synallaxis erythrothorax furtiva Bangs and Peters

Synallaxis erythrothorax furtiva Bangs and Peters, Bull. Mus. Comp. Zoöl., **67**, 1927, p. 476.

Type.— No. 233,783, ♂; Vera Cruz, Precedio; 22 March, 1925; W. W. Brown.

Synallaxis gularis Lafresnaye

now Synallaxis gularis gularis Lafresnaye

Synallaxis gularis Lafresnaye, Rev. Zoöl., 1843, p. 290.

Type.— No. 77,274; Lafresnaye Collection, no. 2,450; "Colombie." Two more specimens, one of which was immature, are in the Lafresnaye Collection, but apparently are not cotypes.

Synallaxis candei d'Orbigny and Lafresnaye

now Poecilurus candei candei (d'Orbigny and Lafresnaye)

Synnalaxis (sic) *candei* d'Orbigny and Lafresnaye, Rev. Zoöl., 1838, p. 165.

Type.— No. 77,261; Lafresnaye Collection, no. 2,452 bis; "Carthagene."

Siptornis hellmayri Bangs

now Cranioleuca hellmayri (Bangs)

Siptornis hellmayri Bangs, Proc. Biol. Soc. Washington, **20**, 1907, p. 55.

Type.— No. 106,184, ♂; Colombia, Santa Marta Mountains, El Paramo de Macotama; 1 February, 1899; W. W. Brown.

Acrorchilus erythrops griseigularis Ridgway

now Cranioleuca erythrops griseigularis (Ridgway)

Acrorchilus erythrops griseigularis Ridgway, Proc. Biol. Soc. Washington, **22**, 1909, p. 72.

Type.— No. 120,673, ♂; western Colombia, San Antonio, Rio Cali; 4 November, 1907; M. G. Palmer.

Synallaxis maluroides d'Orbigny and Lafresnaye

now Asthenes maluroides (d'Orbigny and Lafresnaye)

Synallaxis maluroides d'Orbigny and Lafresnaye, Mag. Zoöl., 1837, p. 22.

Cotype.— No. 77,272; Lafresnaye Collection, no. 2,467; "Buenos ayres, en hiver dans les jonces des bords de la plata."

Cotype.— No. 77,273; Lafresnaye Collection, no. 2,468; "Buenos ayres, Bords de la plata."

† Anabates aradoides Lafresnaye

= Drioctistes erythrophthalmus erythrophthalmus (Wied)

Anabates aradoides Lafresnaye, Mag. Zoöl., 1832, pl. 8.

Type.— No. 77,248; Lafresnaye Collection, no. 2,362 bis; "Du Bresil."

Anabates erythrophthalmus Wied, Reise Bras., **2**, 1821, p. 147.

Anumbius striaticeps d'Orbigny and Lafresnaye

now Phacellodomus striaticeps striaticeps (d'Orbigny and Lafresnaye)

Anumbius striaticeps d'Orbigny and Lafresnaye, Mag. Zoöl., 1838, p. 19.

Cotype.— No. 77,192; Lafresnaye Collection, no. 2,421; "sica sica, d'Orb."

Synallaxis striaticollis Lafresnaye

now Siptornis striaticollis (Lafresnaye)

Synnalaxis (sic) *striaticollis* Lafresnaye, Rev. Zoöl., 1843, p. 290.

Type.— No. 77,279; Lafresnaye Collection, no. 2,484; "Colombie ou Nlle. Grenade."

A second specimen has a very differently worded label, and evidently was acquired by Lafresnaye at a later date.

Anabates squamiger d'Orbigny and Lafresnaye

now Margarornis squamiger squamiger (d'Orbigny and Lafresnaye)

Anabates squamiger d'Orbigny and Lafresnaye, Mag. Zoöl., 1838, p. 14.

Type.— No. 77,095; Lafresnaye Collection, no. 2,296; "Perou ayupaya, d'Orb."

Hellmayr tells me that no specimen of this species, collected by d'Orbigny, exists in the Paris Museum, and having seen our example agrees with me in considering it the type.

Premnoplex coloratus Bangs

now Premnoplex brunnescens coloratus Bangs

Premnoplex coloratus Bangs, Proc. New Eng. Zoöl. Club, **3**, 1902, p. 84.

Type.— No. 106,149, ♀; Colombia, Santa Marta Mountains, San Miguel; 29 January, 1899; W. W. Brown.

ANABATES BOISSONNEAUTII Lafresnaye

now PSEUDOCOLAPTES BOISSONNEAUTII BOISSONNEAUTII (Lafresnaye)

Anabates Boissonneautii Lafresnaye, Rev. Zoöl., 1840, p 104.

Type.— No. 77,186; Lafresnaye Collection, no. 2,349; "Bogotá." Three additional specimens are not cotypes, but were received by Lafresnaye at a much later date, their labels bearing references to current literature of 1844 and 1845.

ANABATES GUTTURALIS d'Orbigny and Lafresnaye

now PSEUDOSEISURA GUTTURALIS (d'Orbigny and Lafresnaye)

Anabates gutturalis d'Orbigny and Lafresnaye, Mag. Zoöl., 1838, p. 15.

Cotype.— No. 77,195; Lafresnaye Collection, no. 2,429; "Patagonia." This example, like all our d'Orbigny birds, has been passed upon by Hellmayr, who considers it a cotype.

XENOPS RUFOSUPERCILIATUS Lafresnaye

now XENOCTISTES RUFOSUPERCILIATUS RUFOSUPERCILIATUS (Lafresnaye)

Xenops rufosuperciliatus Lafresnaye, Mag. Zoöl., 1832, pl. 7, (8th page of text and plate).

Type.— No. 77,191; Lafresnaye Collection, no. 2,356; "Bresil." There is another example, with a somewhat similar label, Lafresnaye Collection, no. 2,355, but Hellmayr, who has seen both, considers that the latter is not a cotype.

ANABACERTHIA STRIATICOLLIS Lafresnaye

now ANABACERTHIA STRIATICOLLIS STRIATICOLLIS Lafresnaye

Anabacerthia striaticollis Lafresnaye, Dict. Univ., **1**, 1840, p. 412.

Cotype.— No. 77,223; Lafresnaye Collection, no. 2,337; "Bogotá."
Cotype.— No. 77,224; Lafresnaye Collection, no. 2,338; "Bogotá."
This is the Bogota form called by Hellmayr (Cat. Birds Americas, pt. 4, 1925, p. 196) *Xenicopsoides montanus striaticollis* (Sclater).

Since, however, the description in d'Orbigny's Dictionnaire Universelle antedates not only Sclater's *Anabates striaticollis* (Proc. Zoöl. Soc. London, 1857, p. 25), but also Tschudi's *Anabates montanus* (Archiv. Naturg., **10**, 1844, p. 295), and since the generic name *Ana-*

bacerthia Lafresnaye (Dict. Univ., **1**, 1840, p. 412) is many years earlier than *Xenicopsoides* Cory (Auk, **36**, 1919, p. 273) the species and subspecies listed by Hellmayr (l. c., pp. 195–199) should stand as follows:

Anabacerthia striaticollis striaticollis Lafresnaye
Anabacerthia striaticollis yungae (Chapman)
Anabacerthia striaticollis montanus (Tschudi)
Anabacerthia striaticollis anxius (Bangs)
Anabacerthia striaticollis venezuelanus (Hellmayr)
Anabacerthia striaticollis temporalis (Sclater)
Anabacerthia striaticollis variegaticeps (Sclater)
Anabacerthia amaurotis (Temminck)

Any one who has not seen Lafresnaye's two cotypes, might be misled by the diagnosis, which describes the top of the head as well as the tail as cinnamon-brown, whereas the color of the head is really olivaceous, rather than cinnamon-brown like the tail.

Xenicopsis anxius Bangs

now Anabacerthia striaticollis anxius (Bangs)

Xenicopsis anxius Bangs, Proc. New Eng. Zoöl. Club, **3**, 1902, p. 83.

Type.— No. 106,154, ♂; Colombia, Santa Marta Mountains, Chirua; 17 February, 1899; W. W. Brown.

† Xenicopsis variegaticeps idoneus Bangs

= Anabacerthia striaticollis variegaticeps (Sclater)

Xenicopsis variegaticeps idoneus Bangs, Proc. Biol. Soc. Washington, **19**, 1906, p. 108.

Type.— No. 108,943, ♂; Panama, Boquete; 4 March, 1901; W. W. Brown.

Anabazenops variegaticeps Sclater, P. Z. S., **24**, 1856, p. 289.

I now quite agree with both Ridgway and Hellmayr that the Panama bird is not sufficiently different from the Mexican to stand as a subspecies.

Automolus rufipectus Bangs

now Automolus rubiginosus rufipectus Bangs

Automolus rufipectus Bangs, Proc. Biol. Soc. Washington, **12**, 1898, p. 158.

Type.— No. 105,580, ♂; Colombia, Santa Marta Mountains, Pueblo Viejo; 21 March, 1898; W. W. Brown.

Automolus exsertus Bangs

now Automolus ochrolaemus exsertus Bangs

Automolus exsertus Bangs, Auk, **18**, 1901, p. 367.

Type.— No. 107,868, ♀; Panama, Divala; 29 November, 1900; W. W. Brown.

Automolus ochrolaemus amusos Peters

Automolus ochrolaemus amusos Peters, Bull. Mus. Comp. Zoöl., **69**, 1929, p. 441.

Type.— No. 136,726, ♂ ad.; Honduras, Lancetilla; 23 March, 1928; J. L. Peters.

† Rhopoctites alogus Bangs

= Thripadectes virgaticeps sclateri Berlepsch

Rhopoctites alogus Bangs, Proc. Biol. Soc. Washington, **23**, 1910, p. 72.

Type.— No. 123,438, ♂; western Colombia, Pavas; 8 February, 1908; M. G. Palmer.

Thripadectes sclateri Berlepsch, Ornis, **14**, 1907, p. 365.

Sclerurus albigularis propinquus Bangs

Sclerurus albigularis propinquus Bangs, Proc. Biol. Soc. Washington, **13**, 1899, p. 99.

Type.— No. 106,152, ♀; Colombia, Santa Marta Mountains,Chirua; 7 February, 1899; W. W. Brown.

Sclerurus mexicanus pullus Bangs

Sclerurus mexicanus pullus Bangs, Proc. New Eng. Zoöl. Club, **3**, 1902, p. 45.

Type.— No. 108,566, ♂; Panama, Boquete; 20 April, 1901; W. W. Brown.

Sclerurus mexicanus anomalus Bangs and Barbour

Sclerurus mexicanus anomalus Bangs and Barbour, Bull. Mus. Comp. Zoöl., **65**, 1922, p. 209.

Type.— No. 87,367, ♀; eastern Panama, Mount Sapo; 25 April, 1922; Barbour, Brooks and Underwood.

DENDROCOLAPTIDAE

(The order here follows Hellmayr, op. cit.)

Dendrocops sancti-thomae Lafresnaye

now Dendrocolaptes certhia sancti-thomae (Lafresnaye)

Dendrocopus sancti-thomae Lafresnaye, Rev. et Mag. Zoöl., 1852, p. 466.

Type.— No. 77,102; Lafresnaye Collection, no. 2,320; "Sancto-Thomae insula" = Santo Tomas, Honduras.

Dendrocolaptes sancti-thomae hesperius Bangs

now Dendrocolaptes certhia hesperius Bangs

Dendrocolaptes sancti-thomae hesperius Bangs, Auk, **24**, 1907, p. 299.

Type,— No. 119,119, ♂; Costa Rica, Lagarto, Boruca; 27 May, 1906; C. F. Underwood.

This very well-marked form appears to be wholly confined to the Terrabá Valley in southwestern Costa Rica.

† Dendrocolaptes variegatus Ridgway

= Dendrocolaptes picumnus picumnus Lichtenstein

Dendrocolaptes variegatus Ridgway, Proc. U. S. Nat. Mus., **11**, 1899, p. 546.

Type.— No. 84,840; Lafresnaye Collection, no. 2,214; "Bahia" = Cayenne.

Dendrocolaptes picumnus Lichtenstein, Abhandl. Akad. Wiss., 1818–19(=1820) p. 202.

Dendrocolaptes perrotii Lafresnaye

now hylexetastes perrotii perrotii (Lafresnaye)

Dendrocolaptes perrotii Lafresnaye, Rev. Zoöl., 1844, p. 80.

Type.— No. 77,104; Lafresnaye Collection, no. 2,221.

Lafresnaye received the type of this species from M. Perrot, preparateur attached to the Paris Museum, for whom he named it. He says (Rev. et Mag., 1850, p. 101) that he did not know whence it came, but that it was perhaps the only specimen in France. It is still in excellent condition, but has undergone a curious change through fading;

apparently the left side had been exposed to direct sunlight for many years and is very much bleached, whereas the right side, away from the light, has retained practically its original colors.

† XIPHOCOLAPTES CINNAMOMEUS Ridgway

= XIPHOCOLAPTES FALCIROSTRIS (Spix)

Xiphocolaptes cinnamomeus Ridgway, Proc. U. S. Nat. Mus., **12**, 1890, p. 15.

Type.— No. 7,868; Ceara "trade skin."

Dendrocolaptes falcirostris Spix, Av. Bras., **1**, 1824, p. 86, pl. 88.

† DENDROCOLAPTES RUBIGINOSUS Lafresnaye

= XIPHOCOLAPTES MAJOR MAJOR (Vieillot)

Dendrocolaptes rubiginosus Lafresnaye, Mag. Zoöl., 1833, cl. 2, pl. 16, text.

Type.— No. 77,103; Lafresnaye Collection, no. 2,216.

Dendrocopus major Vieillot, Nouv. Dict. Hist. Nat., **26**, 1818, p. 118.

Lafresnaye published this supposed species of his as coming from Buenos Ayres, which, of course, was in error, but he wrote two labels for his type, in the first of which he says, "Paraguay, Prix 25 francs" and on the second "Buenos Ayres (Chiquitos orb.)."

† DENDROPLEX PICUS BAHIÆ Bangs and Penard

= DENDROPLEX PICUS PICUS (Gmelin)

Dendroplex picus bahiæ Bangs and Penard, Bull. Mus. Comp. Zool., **64**, 1921, p. 369.

Type.— No. 73,792; Bahia "trade skin."

Oriolus picus Gmelin, Syst. Nat., **1**, 1788, p. 384.

Hellmayr does not recognize *bahiæ* although he admits that birds from eastern Brazil average more rufescent on the underparts than those from the Guianas.

DENDROCOLAPTES ALTIROSTRIS Léotaud

now DENDROPLEX PICUS ALTIROSTRIS (Léotaud)

Dendrocolaptes altirostris Léotaud, Ois. Trinidad, 1866, p. 166.

Type.— No. 77,156; Lafresnaye Collection, no. 2,279, ♀ ; Trinidad, Léotaud.

Penard and I (Bull. Mus. Comp. Zoöl., **64**, 1921, p. 367) have already published an account of this very interesting type, telling how it found its way into Lafresnaye's Collection.

Dendroplex picirostris Lafresnaye

now Dendroplex picirostris picirostris Lafresnaye

Dendroplex picirostris Lafresnaye, Rev. Zoöl., 1847, p. 76.

Cotype.— No. 77,106; Lafresnaye Collection, 2,283; "Nlle. Grenada, Riohacha delatr."

The specimen in the Philadelphia Academy Collection listed by Stone (Proc. Acad. Nat. Sci. Phil., 1899, p. 51) as the type bears the legend, "N. Grenada, Delattre Coll." with no mention of the type locality Rio Hacha. I am forced in this case as in some others, with Dr. Stone's approval, to consider Lafresnaye's specimen a cotype, even though the species was originally described from the Delattre Collection, the assumption being that where there were duplicates, Lafresnaye was allowed to keep one for his own cabinet.

Nasica guttatoides Lafresnaye

now Xiphorhynchus guttatus guttatoides (Lafresnaye)

Nasica guttatoides Lafresnaye, Rev. et Mag. Zoöl., 1850, p. 387.

Type.— No. 77,146; Lafresnaye Collection, no. 2,258.

For this specimen Lafresnaye wrote two labels, the first of which reads — "D. guttatoides nob. mon. 1847, Colombie" and the second — "un Dend. guttatoides nob. a été rapporté par l'expd. Costelman de laretto."

The type is a youngish bird and is in excellent condition. Two other examples, both adults, are not cotypes. They were identified by Lafresnaye as belonging to another species.

Menégaux and Hellmayr (Étude, 1906, p. 60) claim the type of *Nasica guttatoides* for the Paris Museum on the basis of the first specimen mentioned by Lafresnaye, who said — "Cette espèce a été rapportée de Lorette, au Musée par l'expédition Castelnaud, mais nous la possedions déja dans notre collection l'ayant achetée d'un marchand avec quelques oiseaux de Colombie."

I entirely disagree with the conclusions of Menégaux and Hellmayr. The type is, of course, the specimen from which Lafresnaye drew his description and the accidental first mention of an example brought to the Museum at a later date, can not alter the case.

It is perfectly clear from the labels which bird served for the description in the Monograph. The first label definitely refers to the Monograph and even bears the date 1847. It is known that Lafresnaye was engaged a long time in writing his monograph and that he finally waited, before publishing, for an opportunity to examine the Dendrocolaptidae brought back by the Castelnaud expedition to the Museum. His description of *guttatoides* was evidently already complete. The second label shows that Lafresnaye upon his visit to Paris found that a specimen of this bird had been brought to the Museum but it is certain that his own specimen served for his description. I, therefore, agree with Elliot (Auk, 1890, p. 186) that the bird in the Lafresnaye Collection and not the one in the Paris Museum is the type of the subspecies.

Xiphorhynchus rosenbergi Bangs

now Xiphorhynchus guttatus rosenbergi Bangs

Xiphorhynchus rosenbergi Bangs, Proc. Biol. Soc. Washington, **23**, 1910, p. 72.

Type.— No. 123,436, ♂; western Colombia, Guabinas, Rio Cauca; 9 January, 1908; M. G. Palmer.

Dendrornis nana confinis Bangs

now Xiphorhynchus guttatus confinis (Bangs)

Dendrornis nana confinis Bangs, Bull. Mus. Comp. Zoöl., **39**, 1903, p. 150.;

Type.— No. 110,432, ♂; Honduras, La Ceiba; 24 January, 1902; W. W. Brown.

† Nasica albisquama Lafresnaye

= Xiphorhynchus susurrans susurrans (Jardine)

Nasica albisquama Lafresnaye, Rev. Zoöl., 1852, p. 465.

Type.— No. 77,163; Lafresnaye Collection, no. 2,262.

Dendrocolaptes susurrans Jardine, Ann. Mag. Nat. Hist., **19**, 1847, p. 81.

Xiphorhynchus flavigaster tardus Bangs and Peters

Xiphorhynchus flavigaster tardus Bangs and Peters, Bull. Mus. Comp. Zoöl., **68**, 1928, p. 393.

Type.— No. 224,029, ♂; Chihuahua, Hacienda de San Rafael; 7 May, 1888; M. A. Frazar.

Dendrocolaptes triangularis Lafresnaye

now Xiphorhynchus triangularis triangularis (Lafresnaye)

Dendrocolaptes triangularis Lafresnaye, Rev. Zoöl., 1842, p. 134.

Type.— No. 77,147; Lafresnaye Collection, no. 2,275; "Bolivia" (and written over this is) "Colombie, Bogotá."

Two other examples were listed by Verreaux as of this species, one of these is no. 2,276 but is not a cotype. The other, no. 2,274, proves to be *Xiphorhynchus erythropygia* (Sclater).

† Dendrocolaptes mauperthuisii Lafresnaye

= Xiphorhynchus ocellatus ocellatus (Spix)

Dendrocolaptes mauperthuisii Lafresnaye, Rev. Zoöl., 1850, p. 147.

Type.— No. 77,162; Lafresnaye Collection, no. 2,268.

Dendrocolaptes ocellatus (guttatus) Spix, Av. Bras., **1**, 1824, p. 88, pl. 91, fig. 1.

For his specimen, Lafresnaye wrote a label which reads — "Dendrornis Weddelii Laf. (nuper in Mus. Paris olim. mauperthuysii a Pucher. et Laf. confusus) Voy. Castelnaud haut amazone, Pebas, Sta. Maria."

(See remarks under the next species.)

† Nasica beauperthuysii Lafresnaye

= Xiphorhynchus ocellatus ocellatus (Spix)

Nasica Beauperthuysii Lafresnaye, Rev. Zoöl., 1850, p. 419.

Type.— No. 77,161; Lafresnaye Collection, no. 2,267.

Dendrocolaptes ocellatus (guttatus) Spix, Av. Bras., **1**, 1824, p. 88, pl. 91, fig. 1.

Lafresnaye's label for this specimen reads "Nasica Dendrornis Weddelii Laf. deville Mus. Parisiense, N. Beauperthuysii Pucher. et Laf. mon., p. 51 à tort, celuici est de pepas haut amazone Voyage Castelnaud. Le Beauperthuysii a été rapporté du perou par le voyageur Beauperthuys."

It is apparent that when Lafresnaye described *D. mauperthuisii* and again *N. beauperthuysii*, he must have had before him a specimen of *X. ocellatus* (Spix) afterwards redescribed as *D. weddellii* by des Murs (Voy. Castelnau, Ois., 1855, p. 46, pl. 14, fig. 2) from a manuscript

name supplied by Lafresnaye. He did not have in his hands the bird in the Paris Museum collection to which Pucheran and he had given the manuscript name *beauperthuysii*, and which was brought back by Beauperthuys from Venezuela according to Menégaux and Hellmayr (Passereaux Tracheophones, 1906, p. 64) and not from Peru as stated by Lafresnaye.

Lafresnaye's diagnosis of *N. beauperthuysii* agrees perfectly with M. C. Z. no. 77,161, so marked by Lafresnaye, and I have no doubt that his description was drawn entirely from it and not from the specimen in the Paris Museum to which he, of course, naturally refers.

Dendrocolaptes affinis Lafresnaye

now Lepidocolaptes affinis affinis (Lafresnaye)

Dendrocolaptes affinis Lafresnaye, Rev. Zoöl., 1839, p. 100.

Type.— No. 77,151; Lafresnaye Collection, no. 2,237; "Mexico."

The type shows no fading nor discoloration and is in excellent condition. It agrees exactly with birds from Jalapa.

In the article above cited Lafresnaye described a number of new birds from the collection of Charles Brelay of Bordeaux. I think Brelay gave to Lafresnaye one specimen each of three of these species. For these three birds, I find labels, written by Lafresnaye, all similar, and done as he usually did for new birds he described. I, therefore, feel justified in claiming types, or cotypes, of *Myadestes obscurus* and *Piranga sanguinolenta* as well as that of the present species.

The types of the other species described in this article must have remained in the Brelay cabinet. Certain it is that they did not find their way into the Lafresnaye Collection.

Picolaptes affinis lignicida Bangs and Penard

now Lepidcolaptes affinis lignicida (Bangs and Penard)

Picolaptes affinis lignicida Bangs and Penard, Bull. Mus. Comp. Zoöl., **63**, 1919, p. 26.

Type.— No. 49,359, ♂; Tamaulipas, Galindo; 21 March, 1909; F. B. Armstrong.

Dendrocolaptes lacrymiger Lafresnaye

now Lepidocolaptes lacrymiger lacrymiger (Lafresnaye)

Dendrocolaptes lacrymiger Lafresnaye, Rev. Zoöl., 1846, p. 208, no locality given; I designate Bogotá.

Type.— No. 76,142; Lafresnaye Collection, no. 2,235; "Mexique et Colombie?"

Lafresnaye's name as given here is nomen nudum and antedates his later diagnosis in Des Murs Iconographie Ornithologique, plate 70, text (figure pl. 71) from which the species is usually dated. As the specimen listed here is the type of Lafresnaye's earlier diagnosis, it, of course, is the type of the species.

† Picolaptes obtectus Allen

= Lepidocolaptes fuscicapillus fuscicapillus (Pelzeln)

Picolaptes obtectus Allen, Bull. Amer. Mus. N. H., **2**, 1889, p. 94, footnote.

Type.— No. 75,164; Lafresnaye Collection, no. 8,489; (no data).

Picolaptes fuscicapillus Pelzeln, Orn. Bras. **1**, 1868, p. 44, 63.

Dendrocolaptes albolineatus Lafresnaye

now Lepidocolaptes albolineatus (Lafresnaye)

Dendrocolaptes albolineatus Lafresnaye, Rev. Zoöl., 1846, p. 208.

Type.— No. 77,118; Lafresnaye Collection, no. 2,238; "Colombie ou Mexique" (error = Cayenne, Hellmayr).

Picolaptes lineaticeps Lafresnaye

now Lepidocolaptes souleyetii lineaticeps (Lafresnaye)

Picolaptes lineaticeps Lafresnaye, Rev. et Mag. Zoöl., 1850, p. 227.

Type.— No. 77,119; Lafresnaye Collection, no. 2,227; (no data).

Lepidocolaptes souleyetii decoloris Austin

Lepidocolaptes souleyetii decoloris Austin, Bull. Mus. Comp. Zoöl., **69**, 1929, p. 380.

Type.— No. 140,010, ♀ ; British Honduras, Cayo; 18 March, 1928; Oliver L. Austin, Jr.

Xiphorhynchus venezuelensis Chapman

now Campylorhamphus trochilirostris venezuelensis (Chapman)

Xiphorhynchus venezuelensis Chapman, Bull. Amer. Mus. N. H., **2**, 1889, p. 156.

Cotype.— No. 76,087; Lafresnaye Collection, no. 2,246; (no data).

Cotype.— No. 76,088; Lafresnaye Collection, no. 2,247; "Venezuela."

† XIPHORHYNCHUS ISABELLA (ex. Verreaux M. S.) Chapman

= CAMPYLORHAMPHUS TROCHILIROSTRIS VENEZUELENSIS (Chapman)

Xiphorhynchus isabella Chapman, Bull. Am. Mus. N. H., **2**, 1889, p. 157.

Type.— No. 76,089; Lafresnaye Collection, no. 2,251; "Venezuela."

Xiphorhynchus venezuelensis Chapman, Bull. Amer. Mus. N. H., **2**, 1889, p. 156.

Chapman in explaining that the specimen which was the subject of Verreaux's MS. name was only a cream-colored albino, did not mean to create a synonym. Unfortunately, however, he did, and the name has been so quoted by Ridgway in Birds of North and Middle America.

XIPHORHYNCHUS PROCURVOIDES Lafresnaye

now CAMPYLORHAMPHUS PROCURVOIDES (Lafresnaye)

Xiphorhynchus procurvoides Lafresnaye, Rev. et Mag. Zoöl., 1850, p. 376.

Type.— No. 77,120; Lafresnaye Collection, no. 2,241; "Cayenne."

† XIPHORHYNCHUS DORSO-IMMACULATUS Chapman

= CAMPYLORHAMPHUS PROCURVOIDES (Lafresnaye)

Xiphorhynchus dorso-immaculatus Chapman, Bull. Amer. Mus. N. H., **2**, 1889, p. 159.

Type.— No. 76,090; Lafresnaye Collection, no. 2,242; "Cayenne."

Xiphorhynchus procurvoides Lafresnaye, Rev. et Mag. Zoöl., 1850, p. 376.

GLYPHORYNCHUS SPIRURUS SUBLESTUS Peters

Glyphorynchus spirurus sublestus Peters, Bull. Mus. Comp. Zoöl., **69**, 1929, p. 443.

Type.— No. 141,255, ♂; northwest Panama (Caribbean slope), Changuinola; 16 October, 1928; H. Wedel.

SITTASOMUS LEVIS Bangs

now SITTASOMUS GRISEICAPILLUS LEVIS Bangs

Sittasomus levis Bangs, Proc. New Eng. Zoöl. Club, **3**, 1902, p. 46.

Type.— No. 108,568, ♂; Panama, Boquete; 21 January, 1901; W. W. Brown.

Sittasomus griseicapillus gracileus Bangs and Peters

Sittasomus griseicapillus gracileus Bangs and Peters, Bull. Mus. Comp. Zoöl., **68**, 1928, p. 392.

Type.— No. 41,067; Yucatan, Chichen-Itza; 5 February, 1890; E. H. Thompson.

Sittasomus sylvioides Lafresnaye

now Sittasomus griseicapillus sylvioides Lafresnaye

Sittasomus sylvioides Lafresnaye, Rev. et Mag. Zoöl., 1849, p. 331.

Type.— No. 77,039; Lafresnaye Collection, no. 2,295; "Mexique" (restricted to Vera Cruz by Bangs and Peters, Bull. Mus. Comp. Zoöl., **68**, 1928, p. 392).

Deconychura typica darienensis Griscom

Dechonychura [sic] *typica darienensis* Griscom, Bull. Mus. Comp. Zoöl., **69**, 1929, p. 172.

Type.— No. 140,413, ♀ ; Eastern Panama, Cana; 6 August, 1928; Rex R. Benson.

Dendrocolaptes atrirostris d'Orbigny and Lafresnaye

now Dendrocincla atrirostris (d'Orbigny and Lafresnaye)

Dendrocolaptes atrirostris d'Orbigny and Lafresnaye, Mag. Zoöl., 1838, p. 12.

Cotype.— No. 77,089; Lafresnaye Collection, no. 2,308; "Guarayos d'Orb."

Cotype.— No. 77,090; Lafresnaye Collection, no. 2,309; "Guarayos d'Orb."

Hellmayr, who has now seen these specimens, considers them, as well as the one in Paris, to be all cotypes.

A third bird listed by Verreaux as of the same species, no. 2,307, has a label written by Lafresnaye saying it was from "quito" and proposing an MS. name for it. It is an example of *D. meruloides christiani.*

Dendrocincla lafresnayei Ridgway

now Dendrocincla meruloides lafresnayei Ridgway

Dendrocincla lafresnayei Ridgway, Proc. U. S. Nat. Mus., **10**, 1888, p. 492, "Upper Amazon," the type locality fixed by Chapman (Bull. Am. Mus. N. H., **36**, 1917, p. 418) as Valparaiso, Santa Marta, Colombia.

Type.— No. 76,086; Lafresnaye Collection, no. 2,305; (no data).

Ridgway's type is one of two specimens identified as *Dendrocops merula* (Lichtenstein) by Lafresnaye, who, however, noticed its smaller proportions, but thought it might be a female, and wrote on the label "an potior *merula*, ♀ ?, rostro, alii, pedibusque minoribus."

There is nothing to indicate its origin and Ridgway must have taken his locality "Upper Amazon" from the label of the other specimen which *is* an example of *Dendrocincla merula* (Lichtenstein). This latter specimen, M. C. Z. 77,086, Lafresnaye Collection, no. 2,304, has a label which reads — "*Dendrocops merula* nob. mon. 83. *Dend. merula* Licht. mon. mem. de L'ac. de Berl., 1818, p. 208, no. 17. Perou, haut amazone, Castelnaud."

In referring to this bird as the type of *merula* Ridgway was misled by the authority "nob." on the label, which here merely means that the combination with *Dendrocops* was Lafresnaye's. Thus Menégaux and Hellmayr (Auk, 1906, **23**, p. 481) are right in saying that neither of the two specimens mentioned by Ridgway (loc. cit., p. 493) is the type of *Dendrocolaptes merula* Licht., nor did Lafresnaye himself claim either as a type, as the original labels show.

Incidentally, Menégaux and Hellmayr state (loc. cit., p. 482) that "the whole collection of Count Castelnau's expedition to South America was deposited in the Paris Museum, where consequently all the types of the 'Voyage de l'amérique du sud' remained." This may be so, but still Lafresnaye had some means of obtaining, for his own collection, specimens from that expedition, as shown conclusively by the label just quoted above, and by many another.

The type of *D. lafresnayei* agrees exactly, making due allowance for fading in a specimen that has been on exhibition for at least half a century, with the Santa Marta bird described by me as *Dendrocincla olivacea anguina* (Proc. Biol. Soc. Wash., **12**, 1898, p. 138) and I wholly agree with Chapman in fixing the type locality as Valparaiso, Santa Marta, Colombia.

† Dendrocincla olivacea anguina Bangs

= Dendrocincla meruloides lafresnayei Ridgway

Dendrocincla olivacea anguina Bangs, Proc. Biol. Soc. Washington, **12**, 1898, p. 138.

Type.— No. 105,327, ♂; Colombia, Santa Marta; 15 February, 1898; W. W. Brown.

Dendrocincla lafresnayei Ridgway, Proc. U. S. Nat. Mus., **10**, 1888, p. 489, 492.

Dendrocincla lafresnayei christiani Bangs and Penard

now Dendrocincla meruloides christiani Bangs and Penard

Dendrocincla lafresnayei christiani Bangs and Penard, Bull. Mus. Comp. Zoöl., **63**, 1919, p. 25.

Type.— No. 124,522, ♀ ; western Colombia, Pavas; 10 March, 1908; M. G. Palmer.

Chapman does not look upon this form with favor; Hellmayr, however, recognizes it and I never have seen a specimen that I could not tell with ease from *D. m. ridgwayi* of Panama, its nearest ally.

Dendrocops tyranninus Lafresnaye

now Dendrocincla tyrannina tyrannina (Lafresnaye)

Dendrocops tyranninus Lafresnaye, Rev. et Mag. Zoöl., 1851, p. 328.

Cotype.— No. 77,083; Lafresnaye Collection, no. 2,302; "Sta fé de Bogotá."

Cotype.— No. 77,084; Lafresnaye Collection, no. 2,303; "Sta fé de Bogotá."

TYRANNIDAE

(The order followed here is that of Hellmayr, Birds of the Americas, pt. 5, 1927)

Pepoaza montana d'Orbigny and Lafresnaye

now Agriornis montana montana (d'Orbigny and Lafresnaye)

Pepoaza montana d'Orbigny and Lafresnaye, Mag. Zoöl., 1837, p. 64.

Cotype.— No. 77,313; Lafresnaye Collection, no. 8,387; "Chuquisca, Rep. Boliviana d'Orb."

Hellmayr, who has examined this specimen, says that it, like the one in Paris, is a "young bird in fluffy plumage, without attenuation of the outer primaries."

Muscisaxicola albilora Lafresnaye

Muscisaxicola albilora Lafresnaye, Rev. et Mag. Zoöl., 1855, p. 60.

Type.— No. 77,322; Lafresnaye Collection, no. 4,604; (no locality given — Santiago, Chile, suggested by Bangs and Penard).

Muscisaxicola flavinucha Lafresnaye

Muscisaxicola flavinucha Lafresnaye, Rev. et Mag. Zoöl., 1855, p. 59, pl. 3.

Type.— No. 77,314; Lafresnaye Collection, no. 4,605, "chily." A second specimen, no. 4,605, is not a cotype.

† Muscisaxicola albimentum Lafresnaye

= Muscisaxicola macloviana mentalis d'Orbigny and Lafresnaye

Muscisaxicola albimentum Lafresnaye, Rev. et Mag. Zoöl., 1855, p. 61.

Type.— No. 77,323; Lafresnaye Collection, no. 4,607; "Bolivia et Patagonia."

Muscisaxicola mentalis d'Orbigny and Lafresnaye, Mag. Zoöl., 1837, cl. 2, pls. 77–79.

† Saxicola fumifrons Peale

= Muscisaxicola macloviana mentalis d'Orbigny and Lafresnaye

Saxicola fumifrons Peale, U. S. Expl. Exped., 1848, p. 90.

Cotype.— No. 75,849; Peru; U. S. Expl. Exped.

Muscisaxicola mentalis d'Orbigny and Lafresnaye, Mag. Zoöl., 1837, cl. 2, pls. 77, 79.

Peale says only of his *Saxicola fumifrons* that it was found on arid ground near Callao, but does not state how many examples he secured.

Tyrannula fumigata Boissonneau

now Ochthodiaeta fumigata fumigata (Boissonneau)

Tyrannula fumigata Boissonneau, Rev. Zoöl., 1840, p. 71.

Type.— No. 76,094; Lafresnaye Collection, no. 4,552; "Sta fé de Bogotá."

Lafresnaye's label for this specimen is similar to those for all the birds described in the article quoted above, and reads — "Tyrannula fumigata B. nob. rev. Zoöl., 1840, p. 71, Sta. fé de Bogotá."

Ochthodiaeta pernix Bangs

Ochthodiaeta pernix Bangs, Proc. Biol. Soc. Washington, **13**, 1899, p. 95.

Type.— No. 106,004, ♂; Colombia, Santa Marta Mountains, Macotama; 4 February, 1899; W. W. Brown.

FLUVICOLA LEUCOPHRYS d'Orbigny and Lafresnaye

now OCHTHOECA LEUCOPHRYS LEUCOPHRYS (d'Orbigny and Lafresnaye)

Fluvicola leucophrys d'Orbigny and Lafresnaye, Mag. Zoöl., 1837, p. 60.

Cotype.— No. 77,340; Lafresnaye Collection, no. 4,557; "Sica sica, Bolivia."

MUSCICAPA CINNAMOMEIVENTRIS Lafresnaye

now OCHTHOECA CINNAMOMEIVENTRIS (Lafresnaye)

Muscicapa cinnamomeiventris Lafresnaye, Rev. Zoöl., 1843, p. 291.

Cotype.— No. 77,336; Lafresnaye Collection, no. 4,554; "Colomb. ou Nlle. grenade."

Cotype.— No. 77,337; Lafresnaye Collection, no. 4,555; "Colombie."

SETOPHAGA ALBIDIADEMA Lafresnaye

now OCHTHOECA ALBIDIADEMA ALBIDIADEMA (Lafresnaye)

Setophaga albidiadema Lafresnaye, Rev. Zoöl., 1848, p. 8.

Type.— No. 77,339; Lafresnaye Collection, no. 4,556; "Colombie."

† MUSCICAPA FUSCOCAPILLA Lafresnaye

= OCHTHOECA DIADEMA DIADEMA (Hartlaub)

Muscicapa fusco-capilla Lafresnaye, Rev. Zoöl., 1843, p. 291.

Type.— No. 83,384; Lafresnaye Collection, no. 8,404; "Colombie ou Nlle. grenade."

Myiobius diadema Hartlaub, Rev. Zoöl., 1843, p. 289.

SAYORNIS NIGRICANS BRUNNESCENS Grinnell

Sayornis nigricans brunnescens Grinnell, Auk, **44**, 1927, p. 69.

Type.— No. 216,739; Lower California, San José del Cabo; 11 October, 1887; M. A. Frazar.

SAYORNIS AMNICOLA Bangs

now SAYORNIS NIGRICANS AMNICOLA Bangs

Sayornis amnicola Bangs, Proc. New Eng. Zoöl. Club, **3**, 1902, p. 37.

Type.— No. 108,543; Panama, Boquete; 21 January, 1901; W. W. Brown.

Copurus leuconotus Lafresnaye

now Colonia colonus leuconota Lafresnaye

Copurus leuconotus Lafresnaye, Rev. Zoöl., 1842, p. 335.

Cotype.— No. 77,331; Lafresnaye Collection, no. 4,594; "Colombie."

Cotype.— No. 77,332; Lafresnaye Collection, no. 4,596; "Colombie."

A third specimen in the collection is not a cotype. Although Lafresnaye gave Bolivia as the region of his new species in his published account of it, the word "Colombie" alone appears on the labels of both cotypes.

Pyrocephalus rubineus blatteus Bangs

now Pyrocephalus rubinus blatteus Bangs

Pyrocephalus rubineus blatteus Bangs, Proc. Biol. Soc., Washington, **24**, 1911, p. 189.

Type.— No. 119,812, ♂; British Honduras, Sabune district; 21 May, 1906; M. E. Peck.

Muscigralla brevicauda d'Orbigny and Lafresnaye

Muscigralla brevicauda d'Orbigny and Lafresnaye, Mag. Zoöl., 1837, p. 61.

Cotype.— No. 77,334; Lafresnaye Collection, no. 4,611; "Tacna, perou sur la côte."

This cotype Hellmayr thinks might almost be considered the "type" as the specimen in Paris is marked only "Peru."

Tyrannus magnirostris d'Orbigny

now Tyrannus cubensis Richmond

Tyrannus magnirostris d'Orbigny, in La Sagra's Hist. Nat. Cuba, Ois., 1840, p. 80, pl. 13. (Not *Tyrannus magnirostris* Swainson, 1831).

Tyrannus cubensis Richmond, Auk, **15**, 1898, p. 330, new name to replace *Tyrannus magnirostris* d'Orbigny preoccupied.

Type.— No. 84,591; Lafresnaye Collection, no. 4,729; "tyr. magnirostris nob. ty. àgrosbec — junr. avis? Pipiris à tête noir ou pigrosbec — Cuba."

This species, as well as several others described in the article quoted above, was based on a specimen in Lafresnaye's cabinet.

Tyrannus crassirostris pompalis Bangs and Peters

Tyrannus crassirostris pompalis Bangs and Peters, Bull. Mus. Comp. Zoöl., **68**, 1928, p. 396.

Type.— No. 223,593, ♂; Chihuahua, Hacienda de San Rafael; 7 May, 1888; M. A. Frazar.

Scaphorhynchus mexicanus Lafresnaye

now Megarynchus pitangua mexicanus (Lafresnaye)

Scaphorhynchus mexicanus Lafresnaye, Rev. et Mag. Zoöl., 1851, p. 473.

Type.— No. 83,359; Lafresnaye Collection, no. 4,721; "Mexique."

The two other examples in the collection I do not consider cotypes; one, no. 4,722, is the specimen referred to by Lafresnaye as having a red instead of a yellow crest. The other is an immature.

† Tyrannula icterophrys Lafresnaye

= Conopias cinchoneti (Tschudi)

Tyrannula icterophrys Lafresnaye, Rev. Zoöl., 1845, p. 341.

Type.— No. 83,351; Lafresnaye Collection, no. 8,389; "Bogotá."

Tyrannus cinchoneti Tschudi, Arch. Naturg., **10**, 1844, p. 272.

Tyrannula erythroptera Lafresnaye

now Myiozetetes cayanensis erythropterus (Lafresnaye)

Tyrannula erythroptera Lafresnaye, Rev. et Mag. Zoöl., 1853, p. 56.

Cotype.— No. 83,362; Lafresnaye Collection, no. 4,761; "Brazil."

Cotype.— No. 83,363; Lafresnaye Collection, no. 4,762; "Bresil."

In the article quoted above, Lafresnaye refers to specimens he had seen in the Paris Museum, from which he took his type locality. His own example appears, however, to have served him for the description of the species.

Myiozetetes cayanensis harterti Bangs and Penard

Myiozetetes cayanensis harterti Bangs and Penard, Bull. Mus. Comp. Zoöl., **64**, 1921, p. 374.

Type.— No. 107,203, ♀; Panama, Loma del Leon; 25 March, 1900; W. W. Brown.

† TYRANNULA PERUVIANA Lafresnaye

= TYRANNOPSIS SULPHUREA (Spix)

Tyrannula Peruviana Lafresnaye, Rev. et Mag. Zoöl., 1853, p. 56.

Type.— No. 83,349; Lafresnaye Collection, no. 4,751; (no data).

Muscicapa sulphurea Spix, Av. Bras., **2**, 1825, p. 16, pl. 20.

SAUROPHAGUS GUATIMALENSIS Lafresnaye

now PITANGUS SULPHURATUS GUATIMALENSIS (Lafresnaye)

Saurophagus Guatimalensis Lafresnaye, Rev. et Mag. Zoöl., 1852, p. 462.

Type.— No. 83,353; Lafresnaye Collection, no. 4,702; Guatemala.

This well-marked Central American form has been formally reinstated by Peters. (Bull. Mus. Comp. Zoöl., **69**, 1929, p. 448).

SAUROPHAGUS RUFIPENNIS Lafresnaye

now PITANGUS SULPHURATUS RUFIPENNIS (Lafresnaye)

Saurophagus rufipennis Lafresnaye, Rev. et Mag. Zoöl., 1851, p. 471.

Cotype.— No. 83,355; Lafresnaye Collection, no. 4,704; "Caracas et Colombie."

Cotype.— No. 83,356; Lafresnaye Collection, no. 4,705; "Caracas et Colombie."

SAUROPHAGUS BOLIVIANUS Lafresnaye

now PITANGUS SULPHURATUS BOLIVIANUS (Lafresnaye)

Saurophagus Bolivianus Lafresnaye, Rev. et Mag. Zoöl., 1852, p. 463.

Type.— No. 83,357; Lafresnaye Collection, no. 4,706; "Chuquisaca, Bolivia, d'Orb."

Lafresnaye (*l.c.* 464) mentions two specimens, but the other, no. 4,707, cannot be considered a cotype. It is an immature bird in a state of plumage that was not mentioned in the original description.

PITANGUS LICTOR PANAMENSIS Bangs and Penard

Pitangus lictor panamensis Bangs and Penard, Bull. Mus. Comp. Zoöl., **62**, 1918, p. 78.

Type.— No. 107,214, ♂; Panama, Loma del Leon; 7 March, 1900; W. W. Brown.

Pitangus bahamensis Bryant

now Tolmarchus caudifasciatus bahamensis (Bryant)

Pitangus bahamensis Bryant, Proc. Bost. Soc. N. H., **9**, 1864, p. 279.

Type.— No. 46,714; Bahamas, Nassau; 20 April, 1857; H. Bryant.

Tyrannus caudifasciatus d'Orbigny

now Tolmarchus caudifasciatus caudifasciatus (d'Orbigny)

Tyrannus caudifasciatus d'Orbigny in La Sagra Hist. Nat. Cuba, Ois., 1840, p. 70, pl. 12.

Cotype.— No. 84,592; Lafresnaye Collection, no. 4,711; label "Tyran caudifasciatus nob. Cuba."

Cotype.— No. 84,593; Lafresnaye Collection, no. 4,710; label "T. caudifasciatus Lafr. Cuba."

Cotype.— No. 84,594; Lafresnaye Collection, no. 4,712; label "Tyrannus caudi-fasciatus nob. Cuba."

† Myiarchus crinitus boreus Bangs

= Myiarchus crinitus crinitus (Linné)

Myiarchus crinitus boreus Bangs, Auk, **15**, 1898, p. 179.

Type.— No. 100,713, ♂; Mass., Scituate; 28 June, 1883; E. A. and O. Bangs.

Turdus crinitus Linné, Syst. Nat., ed. 10, **1**, 1758, p. 170.

The great-crested flycatcher must, of course, be subdivided. The large billed bird of south Florida is quite different from the small billed northern race. Unfortunately, the type locality of the species is South Carolina, and birds from South Carolina are intermediate, and the question is, which form shall bear the new name. After looking over much material it seems to me that the Florida bird stands farther away from the intermediate of South Carolina, than does the northern bird, and I, therefore, keep the Florida form as the other named subspecies.

Myiarchus crinitus residuus Howe and King

Myiarchus crinitus residuus Howe and King, Contrib. N. Amer. Orn., **1**, 1902, p. 30.

Type.— No. 49,998, ♂; Florida, Ishtocpoga Lake; 24 March, 1893; W. N. Phelps.

Tyrannus antillarum Bryant

now Myiarchus stolidus antillarum (Bryant)

Tyrannus antillarum Bryant, Proc. Bost. Soc. N. H., **10**, 1866, p. 249.

Type.— No. 46,885; Porto Rico, winter; R. Swift.

Tyrannula stolida lucaysiensis Bryant

now Myiarchus stolidus lucaysiensis (Bryant)

Tyrannula stolida (var. *lucaysiensis*) Bryant, Proc. Bost. Soc. N. H., **11**, 1867, p. 66.

Cotype.— No. 74,553; Bahamas; H. Bryant.

There may be other cotypes extant, as Bryant mentions having collected several specimens.

Myiarchus lawrencei bangsi Nelson

now Myiarchus tuberculifer bangsi Nelson

Myiarchus lawrencei bangsi Nelson, Proc. Biol. Soc. Washington, **17**, 1904, p. 45.

Type.— No. 108,758, ♂; Panama, Boquete; 26 January, 1901; W. W. Brown.

Nuttallornis borealis majorinus Bangs and Penard

now Nuttallornis mesoleucus majorinus Bangs and Penard

Nuttallornis borealis majorinus Bangs and Penard, Proc. Biol. Soc. Washington, **34**, 1921, p. 90.

Type.— No. 55,371, ♂; California, Pine Flats, north fork of San Gabriel River, Los Angeles County; 19 July, 1905; C. H. Richardson, Jr.

Contopus richardsonii peninsulae Brewster

now Myiochanes richardsonii peninsulae (Brewster)

Contopus richardsonii peninsulae Brewster, Auk, **8**, April, 1891, p. 144 (separates issued in advance February 17, 1891).

Cotype.— No. 216,790, ♂; Lower California, Sierra de la Laguna; 9 May, 1887; M. A. Frazar.

Cotype.— No. 216,777, ♀; Lower California, Triumfo; 13 June, 1887; M. A. Frazar.

Tyrannula ardosiaca Lafresnaye

now Myiochanes fumigatus ardosiacus (Lafresnaye)

Tyrannula ardosiaca Lafresnaye, Rev. Zoöl., 1844, p. 80.

Cotype.— No. 77,359; Lafresnaye Collection, no. 4,820; "Colombie."
Cotype.— No. 77,360; Lafresnaye Collection, no. 4,821; "Colombie."

Tyrannula cineracea Lafresnaye

now Myiochanes fumigatus cineraceus (Lafresnaye)

Tyrannula cineracea Lafresnaye, Rev. Zoöl., 1848, p. 7.

Type.— No. 83,338; Lafresnaye Collection, no. 8,400; "Caracas."

Empidonax bahamensis Bryant

now Blacicus caribaeus bahamensis (Bryant)

Empidonax bahamensis Bryant, Proc. Bost. Soc. N. H., **7**, 1859, p. 109.

Cotype.— No. 46,715, ♂; Bahamas, Nassau; H. Bryant.
Cotype.— No. 46,716, ♂; Bahamas, Nassau; H. Bryant.
Bryant mentions having seen three specimens, but only two males are called for in the catalogue of his collection.

†Empidonax traillii alnorum Brewster

= Empidonax traillii traillii (Audubon)

Empidonax traillii alnorum Brewster, Auk, **12**, 1895, p. 161.

Type.— No. 201,367, ♂; Maine, Upton; 3 June, 1872; Wm. Brewster.

Muscicapa traillii Audubon, Birds Amer. folio ed. 1, 1828, pl. 45.

Empidonax griseus Brewster

Empidonax griseus Brewster, Auk, **6**, April, 1889, p. 87 (separates issued in advance, January 31, 1889).

Cotype.— No. 216,889, ♂; Lower California, La Paz; 5 February, 1887; M. A. Frazar.
Cotype.— No. 216,900, ♀; Lower California, La Paz; 11 February, 1887; M. A. Frazar.

Empidonax pulverius Brewster

Empidonax pulverius Brewster, Auk, **6**, April, 1889, p. 86 (separates issued in advance, January 31, 1889).

Cotype.— No. 214,387, ♂; Chihuahua, Pinos Altos; 23 June, 1888; M. A. Frazar.

Cotype.— No. 214,388, ♀; Chihuahua, Pinos Altos; 6 June, 1888; M. A. Frazar.

Empidonax cineritius Brewster

now Empidonax difficilis cineritius Brewster

Empidonax cineritius Brewster, Auk, **5**, 1888, p. 90.

Cotype.— No. 214,136, ♂; Lower California, La Laguna Mountains; 27 April, 1887; M. A. Frazar.

Cotype.— No. 214,137, ♀; Lower California, La Laguna Mountains, 27 April, 1887; M. A. Frazar.

† Empidonax lawrencei nemoralis Penard

= Empidonax lawrencei lawrencei Allen

Empidonax lawrencei nemoralis Penard, Proc. Biol. Soc. Washington, **36**, 1923, p. 63.

Type.— No. 89,286; Surinam, Lelydorp; 26 April, 1922.

Empidonax lawrencei Allen, Bull. Am. Mus. N. H., **2**, 1889, p. 150.

Mitrephanes phaeocercus tenuirostris Brewster

Mitrephanes phaeocercus tenuirostris Brewster, Auk, **5**, 1888, p. 137.

Type.— No. 214,150, ♀; Sonora, near Oposura; 7 June, 1887; J. C. Cahoon.

Myiobius xanthopygus aureatus Bangs

now Myiobius sulphureipygius aureatus Bangs

Myiobius xanthopygus aureatus Bangs, Proc. New Eng. Zoöl. Club, **4**, 1908, p. 27.

Type.— No. 108,036, ♂; Panama, Divala; 21 November, 1900; W.W. Brown.

Tyrannula ornata Lafresnaye

now Myiotriccus ornatus ornatus (Lafresnaye)

Tyrannula ornata Lafresnaye, Rev. et Mag. Zoöl., 1853, p. 57.

Cotype.— No. 83,342; Lafresnaye Collection, no. 4,780; "Colombie."
Cotype.— No. 83,343; Lafresnaye Collection, no. 4,781; "Colombie."

Muscicapa (tyrannula) vieillotioides Lafresnaye

now Pyrrhomyias vieillotioides vieillotioides (Lafresnaye)

Muscicapa (Tyrannula) vieillotioides Lafresnaye, Rev. Zoöl., 1848, p. 174.

Cotype.— No. 83,346; Lafresnaye Collection, no. 4,778; "Caracas."
Cotype.— No. 83,347; Lafresnaye Collection, no. 4,779; "Caracas."

Muscipeta cinnamomea d'Orbigny and Lafresnaye

now Pyrrhomyias cinnamomea cinnamomea (d'Orbigny and Lafresnaye)

Muscipeta cinnamomea d'Orbigny and Lafresnaye, Mag. Zoöl., 1837, p. 49.

Cotype.— No. 83,344; Lafresnaye Collection, no. 4,776; "Yungas, rare."

Hellmayr considers this specimen a cotype. There is also one male in Paris.

Myiobius naevius furfurosus Thayer and Bangs

now Myiophobus fasciatus furfurosus (Thayer and Bangs)

Myiobius naevius furfurosus Thayer and Bangs, Bull. Mus. Comp. Zoöl., **46**, 1905, p. 152.

Type.— No. 114,397, ♀; Saboga Island, Pearl Islands, Bay of Panama; 9 April, 1904; W. W. Brown.

Onychorhynchus mexicanus fraterculus Bangs

Onychorhynchus mexicanus fraterculus Bangs, Proc. New Eng. Zoöl. Club, **3**, 1902, p. 86.

Type.— No. 105,250, ♂; Colombia, Santa Marta; 4 January, 1898; W. W. Brown.

PLACOSTOMUS CORONATUS GUMIA Bangs and Penard

now PLATYRINCHUS CORONATUS GUMIA (Bangs and Penard)

Placostomus coronatus gumia Bangs and Penard, Bull. Mus. Comp. Zoöl., **62**, 1918, p. 74.

Type.— No. 80,961, ♀ ; Surinam, vicinity of Paramaribo; 20 March, 1914.

RHYNCHOCYCLUS SULPHURESCENS ASEMUS Bangs

now TOLMOMYIAS SULPHURESCENS ASEMUS (Bangs)

Rhynchocyclus sulphurescens asemus Bangs, Proc. Biol. Soc. Washington, **23**, 1910, p. 73.

Type.— No. 123,439, ♂; western Colombia, near Pavas; 15 February, 1908; M. G. Palmer.

RHYNCHOCYCLUS SULPHURESCENS EXORTIVUS Bangs

now TOLMOMYIAS SULPHURESCENS EXORTIVUS (Bangs)

Rhynchocyclus sulphurescens exortivus Bangs, Proc. Biol. Soc. Washington, **21**, 1908, p. 163.

Type.— No. 106,703, ♂; Colombia, Santa Marta Mountains, La Concepcion; 16 March, 1899; W. W. Brown.

CRASPEDOPRION OLIVACEUS BARDUS Bangs and Barbour

now RHYNCHOCYCLUS OLIVACEUS BARDUS (Bangs and Barbour)

Craspedoprion olivaceus bardus Bangs and Barbour, Bull. Mus. Comp. Zoöl., **65**, 1922, p. 216.

Type.— No. 87,029, ♂; Panama, Mount Sapo; 20 April, 1922; Barbour and Brooks.

† TODIROSTRUM FLAVIFRONS Lafresnaye

= TODIROSTRUM POLIOCEPHALUS (Wied)

Todirostrum flavifrons Lafresnaye, Rev. Zoöl., 1846, p. 361.

Cotype.— No. 76,860; Lafresnaye Collection, no. 4,620; "Bresil."
Cotype.— No. 83,374; Lafresnaye Collection, no. 4,619; "Bresil."

Todus poliocephalus Wied, Beitr. Naturg. Bras., **3**, 1831, p. 964.

Todirostrum cinereum finitimum Bangs

Todirostrum cinereum finitimum Bangs, Proc. Biol. Soc. Washington, **17**, 1904, p. 114.

Type.— No. 104,148, ♂; Mexico, Tabasco, San Juan Bautista; 7 March, 1890; L. Barret.

Todirostrum furcatum Lafresnaye

now Ceratotriccus furcatus (Lafresnaye)

Todirostrum furcatum Lafresnaye, Rev. Zoöl., 1846, p. 362.

Type.— No. 83,372; Lafresnaye Collection, no. 4,634; "Brasilia."

† Todirostrum palpebrosum Lafresnaye

= Euscarthmornis orbitatus (Wied)

Todirostrum palpebrosum Lafresnaye, Rev. Zoöl., 1846, p. 362.

Type.— No. 76,858; Lafresnaye Collection, no. 4,637; "Colomb."

Euscarthmus orbitatus Wied, Beitr. Naturg. Bras. **3**, 1831, p. 958.

The second specimen in the Lafresnaye Collection, no. 4,638, is certainly not a cotype.

Todirostrum striaticolle Lafresnaye

now Euscarthmornis striaticollis striaticollis (Lafresnaye)

Todirostrum striaticolle Lafresnaye, Rev. et Mag. Zoöl., 1853, p. 58.

Cotype.— No. 84,369; Lafresnaye Collection, no. 4,635; "Bahia."
Cotype.— No. 84,370; Lafresnaye Collection, no. 4,636; "Bahia."

Todirostrum squamaecrista Lafresnaye

now Lophotriccus pileatus squamaecrista (Lafresnaye)

Fodirostrum (sic) *squamaecrista* Lafresnaye, Rev. Zoöl., 1846, p. 363.

Type.— No. 77,352; Lafresnaye Collection, no. 4,630; "Bogotá."

Cometornis vitiosus Bangs and Penard

now Lophotriccus vitiosus vitiosus (Bangs and Penard)

Cometornis vitiosus Bangs and Penard, Bull. Mus. Comp. Zoöl., **64**, 1921, p. 373.

Type.— No. 77,348; Lafresnaye Collection, no. 4,632; Peru.

† Todirostrum spiciferum Lafresnaye

= Colopteryx galeatus (Boddaert)

Todirostrum spiciferum Lafresnaye, Rev. Zoöl., 1846, p. 363.

Type.— No. 77,347; Lafresnaye Collection, no. 4,633; "Brasilia."

Motacilla galeata Boddaert, Tabl. Pl. Enl., 1783, p. 24.

Muscicapa (todirostrum?) ruficeps Lafresnaye

now Caenotriccus ruficeps (Lafresnaye)

Muscicapa (Todirostrum?) ruficeps Lafresnaye, Rev. Zoöl., 1843, p. 291.

Type.— No. 77,342; Lafresnaye Collection, no. 4,655; "Colombie ou Nlle. grenade."

† Hapalocercus paulus Bangs

= Euscarthmus meloryphus meloryphus (Wied)

Hapalocercus paulus Bangs, Proc. Biol. Soc. Washington, **13**, 1899, p. 96.

Type.— No. 106,115, ♀; Colombia, Santa Marta Mountains, Chirua; 17 March, 1899; W. W. Brown.

Euscarthmus meloryphus Wied, Beitr. Naturg. Bras., **3**, 1831, p. 947.

Hellmayr refuses to recognize the extreme northern form of this species, = *H. paulus*, although he points out certain differences. He has, of course, seen much material, and I therefore follow him. I am, however, easily able to tell the Santa Marta series from the few southern examples available.

Alectrurus flaviventris d'Orbigny and Lafresnaye

now Pseudocolopteryx flaviventris (d'Orbigny and Lafresnaye)

Alecturus (sic) *flaviventris* d'Orbigny and Lafresnaye, Mag. Zoöl., 1837, p. 55.

Cotype.— No. 77,354; Lafresnaye Collection, no. 8,409; "Corrientes."

Cotype.— No. 77,355; Lafresnaye Collection, no. 8,410; "Corrientes."

Hellmayr tells me that the one d'Orbigny specimen in the Paris Museum is without a label, and thinks, therefore, that these two from the type locality might almost be considered the only two cotypes.

Spizitornis parulus curatus Wetmore and Peters

Spizitornis parulus curatus Wetmore and Peters, Auk, **41**, 1924, p. 145.

Type.— No. 85,664; Argentina, Rio Negro, Rio Colorado; 10 August, 1920; J. L. Peters.

Hellmayr relegates this form to the synonymy of his *patagonicus*, but Peters does not agree to this, and still holds, so he tells me, that *curatus* is a valid form.

Stigmatura budytoides inzonata Wetmore and Peters

Stigmatura budytoides inzonata Wetmore and Peters, Proc. Biol. Soc. Washington, **36**, 1923, p. 143.

Type.— No. 86,172, ♂; Argentina, Tucuman, Tapia; 9 April, 1921; J. L. Peters.

Serpophaga cinerea cana Bangs

Serpophaga cinerea cana Bangs, Proc. Biol. Soc. Washington, **17**, 1904, p. 113.

Type.— No. 106,125, ♂; Colombia, Santa Marta Mountains, Chirua; 17 March, 1899; W. W. Brown.

Muscicapa leucophrys d'Orbigny and Lafresnaye

now Mecocerculus leucophrys leucophrys (d'Orbigny and Lafresnaye)

Muscicapa leucophrys d'Orbigny and Lafresnaye, Mag. Zoöl., 1837, p. 53.

Cotype.— No. 83,379; Lafresnaye Collection, no. 4,563; "Bolivia Yungas."

According to Hellmayr, this is a cotype and there is another one in Paris.

† Myiopatis montensis Bangs

= Mecocerculus leucophrys nigriceps Chapman

Myiopatis montensis Bangs, Proc. Biol. Soc. Washington, **13**, 1899, p. 97.

Type.— No. 106,112, ♂; Colombia, Santa Marta Mountains, Paramo de Macotama; 3 March, 1899; W. W. Brown.

Mecocerculus nigriceps Chapman, Bull. Amer. Mus. N. H., **12**, 1899, p. 154.

The Santa Marta form, *montensis* is not identical with *nigriceps* of the mountains of the north coast of Venezuela, but is intermediate

between that form and *setaphagoides* of central Colombia and Venezuela. Hellmayr does not recognize it, and it is probably best kept in synonymy.

† Mecocerculus leucophrys roraimae Bangs and Penard

= Mecocerculus leucophrys roraimae Hellmayr

Mecocerculus leucophrys roraimae Bangs and Penard, Proc. Biol. Soc. Washington, **34**, June, 1921, p. 90.

Type.— No. 83,090, ♀; Roraima; 24 August, 1883; H. Whitely.

Mecocerculus leucophrys roraimae Hellmayr, Anz. Orn. Ges. Bayern, no. 4, March, 1921, p. 30.

Hellmayr and Penard and I both used the same name for this form when we independently described it at the same time. Hellmayr's description appeared just ahead of ours.

Elaenia sordidata Bangs

now Elaenia chiriquensis sordidata Bangs

Elaenia sordidata Bangs, Auk, **18**, 1901, p. 28.

Type.— No. 104,864, ♂; San Miguel Island, Pearl Islands, Bay of Panama; 30 April, 1900; W. W. Brown.

This island form is not recognized by Hellmayr. The Pearl Island bird, when viewed in long series, however, is slightly different in color from true *chiriquensis* of the mainland and has a larger bill.

† Elaenia sororia Bangs

= Elaenia chiriquensis albivertex Pelzeln

Elaenia sororia Bangs, Proc. Biol. Soc. Washington, **12**, 1898, p. 175.

Type.— No. 105,826, ♀; Colombia, Santa Marta Mountains, Palomina; 10 May, 1898; W. W. Brown.

Elainea albivertex Pelzeln, Orn. Bras., **2**, 1868, pp. 107, 177.

Elaenia browni Bangs

now Elaenia obscura browni Bangs

Elaenia browni Bangs, Proc. Biol. Soc. Washington, **12**, 1898, p. 158.

Type.— No. 105,573, ♂; Colombia, Santa Marta Mountains, Pueblo Viejo; 23 March, 1898; W. W. Brown.

Muscicapa albicilla d'Orbigny and Lafresnaye
now Elaenia gaimardii gaimardii (d'Orbigny)

Muscicapa albicilla d'Orbigny and Lafresnaye, Mag. Zoöl., 1837, p. 52. (Not of Pallas, 1826).

Muscicapara gaimardii d'Orbigny, Voyage Amer. Merid., Ois, 1839, p. 326 (new name to replace *Muscicapa albicilla* d'Orbigny and Lafresnaye, preoccupied).

Cotype.— No. 83,368; Lafresnaye Collection, no. 4,653; "Yuracares, Rep. Boliviana."

This is, of course, a cotype and is passed upon as such by Hellmayr, who says that there are also others in Paris.

Myiopagis placens pallens Bangs
now Elaenia viridicata pallens (Bangs)

Myiopagis placens pallens Bangs, Proc. New Eng. Zoöl. Club, **3**, 1902, p. 85.

Type.— No. 105,226, ♀; Colombia, Santa Marta; 9 January, 1898; W. W. Brown.

Myiopagis placens accola Bangs
now Elaenia viridicata accola (Bangs)

Myiopagis placens accola Bangs, Proc. New Eng. Zoöl. Club, **3**, 1902, p. 35.

Type.— No. 108,539, ♂; Panama, Boquete; 1 February, 1901; W. W. Brown.

† Ornithion imberbe ridgwayi Brewster
= Camptostoma imberbe Sclater

Ornithion imberbe ridgwayi Brewster, Bull. Nutt. Orn. Club, 7, 1882, p. 208.

Type.— No. 206,000, ♂; Arizona, Tucson; 1 May, 1881.

Camptostoma imberbe Sclater, P. Z. S., **25**, 1857, p. 203.

Phyllomyias griseocapilla Sclater

Phyllomyias griscocapilla Sclater (ex. Lafresnaye MS. and specimen), P. Z. S., 1867, p. 382, pl. 36, fig. 2.

Type.— No. 84,340; Lafresnaye Collection, no. 4,650; label — "tyus. griseicapillus."

Verreaux in his catalogue of the Lafresnaye collection lists 4,669 as

the type of *Phyllomyias griseocapilla* Lafr. This specimen proves to be *Elaenia caniceps caniceps* (Swains.) and Lafresnaye's label for it was correctly marked to that effect. Goode (U. S. Nat. Mus. Bull., 1896, p. 49) lists the type of Sclater's *P. griseocapilla* as being in the Sclater collection in the British Museum; this cannot be, however, for although Sclater had several specimens, when he described the species, he very definitely designated the Lafresnaye specimen as the type (Proc. Zoöl. Soc. London, 1861, p. 383). Nor does he claim the type in his Catalogue of American Birds.

Tyrannulus nigrocapillus Lafresnaye

now Tyranniscus nigrocapillus nigrocapillus (Lafresnaye)

Tyrannulus nigro-capillus Lafresnaye, Rev. Zoöl., 1845, p. 341.

Typ.— No. 83,375; Lafresnaye Collection, no. 4,674; "Bogotá."

Muscicapa olivacea d'Orbigny and Lafresnaye

now Tyranniscus bolivianus bolivianus (d'Orbigny)

Muscicapa olivacea d'Orbigny and Lafresnaye, Mag. Zoöl., 1837, p. 54 (not of Vieillot).

Muscicapara boliviana d'Orbigny, Voyage Amer. Merid. Ois., 1839, p. 328 (new name to repace *Muscicapa olivacea* d'Orbigny and Lafresnaye preoccupied)

Cotype.— No. 83,383; Lafresnaye Collection, no. 8,420; "Yungas bolivie."

Besides this specimen, Hellmayr tells me there are two in Paris.

Tyrannulus reguloides panamensis Thayer and Bangs

now Tyrannulus elatus panamensis Thayer and Bangs

Tyrannulus reguloides panamensis Thayer and Bangs, Bull. Mus. Comp. Zoöl., **46**, 1906, p. 218.

Type.— No. 114,092, ♂; Panama, near Panama City; 6 May, 1904; W. W. Brown.

Leptopogon pileatus faustus Bangs

now Leptopogon amaurocephalus faustus Bangs

Leptopogon pileatus faustus Bangs, Auk, **24**, 1907, p. 300.

Type.— No. 117,828, ♂; Costa Rica, Boruca; 5 May, 1906; C. F. Underwood.

Leptopogon superciliaris troglodytes Griscom.

Leptopogon superciliaris troglodytes Griscom. Bull. Mus. Comp. Zoöl., **69**, 1929, p. 174.

Type.— No. 140,511, ♀ ; Eastern Panama, Cana; 27 June, 1928; Rex R. Benson.

Leptopogon superciliaris hellmayri Griscom

Leptopogon superciliaris hellmayri Griscom, Bull. Mus. Comp. Zoöl., **69**, 1929, p. 175.

Type.— No. 116,207, ♂; Costa Rica, Carrillo; 23 November, 1898; C. F. Underwood.

Tyrannula rufipectus Lafresnaye

now Leptopogon rufipectus (Lafresnaye)

Tyrannula rufipectus Lafresnaye, Rev. Zoöl., 1846, p. 207, not preoccupied by *Tyrannulus rufipectus* Lesson, according to International Code.

Type.— No. 77,349; Lafresnaye Collection, no. 4,665; "Colombie."

Hellmayr, Catalogue of Birds of the Americas, pt. 5, 1927, p. 490 uses *Leptopogon erythrops* Sclater, P. Z. S., 1862, p. 11 for this species, on the ground that Lafresnaye's name was preoccupied, but according to the International Code Tyrannula and Tyrannulus are different names, and, therefore, Lafresnaye's name must hold.

Mionectes olivaceus hederaceus Bangs

Mionectes olivaceus hederaceus Bangs, Proc. Biol. Soc. Washington, **23**, 1910 p. 73.

Type.— No. 123,442, ♀ ; western Colombia, Pavas; 12 February, 1908.

Mionectes olivaceus galbinus Bangs

Mionectes olivaceus galbinus Bangs, Proc. New Eng. Zoöl. Club, **3**, 1902, p. 85.

Typr.— No. 106,768, ♂; Colombia, Santa Marta Mountains, La Concepcion; 17 March, 1899; W. W. Brown.

Mionectes oleagineus parcus Bangs

now Pipromorpha oleaginea parca (Bangs)

Mionectes oleagineus parcus Bangs, Proc. New Eng. Zoöl. Club, **2**, 1900, p. 20.

Type.— No. 107,187, ♂; Panama, Loma del Leon; 30 March, 1900; W. W. Brown.

Mionectes assimilis dyscolus Bangs

now Pipromorpha oleaginea dyscola (Bangs)

Mionectes assimilis dyscolus Bangs, Auk, **18**, 1901, p. 362.

Type.— No. 107,958, ♀; Panama, Divala; 6 December, 1900; W. W. Brown.

OXYRHAMPHIDAE

Oxyrhamphus brooksi Bangs and Barbour

now Oxyruncus cristatus brooksi (Bangs and Barbour)

Oxyrhamphus brooksi Bangs and Barbour, Bull. Mus. Comp. Zoöl., **65**, 1922, p. 220.

Type.— No. 87,199, ♂; Panama, Mount Sapo; 25 April, 1922; Barbour, Brooks and Underwood.

PIPRIDAE

Pipra chrysoptera Lafresnaye

now Masius chrysopterus chrysopterus (Lafresnaye)

Pipra chrysoptera Lafresnaye, Rev. Zoöl., 1843, p. 97. Figured, Mag. Zoöl., 1843, pl. 44.

Type.— No. 76,274; Lafresnaye Collection, no. 2,075.

There is now no label, written by Lafresnaye, for this specimen, but as it is the only example of the species in the collection, and as also it agrees exactly with the original description it is, of course, the type.

Pipra mentalis ignifera Bangs

Pipra mentalis ignifera Bangs, Auk, **18**, 1901, p. 363.

Type.— No. 107,823, ♂; Panama, Divala; 30 November, 1900; W. W. Brown.

Pipra erythrocephala actinosa Bangs and Barbour

Pipra erythrocephala actinosa Bangs and Barbour, Bull. Mus. Comp. Zoöl., **65**, 1922, p. 214.

Type.— No. 87,170, ♂; Panama, Mount Sapo; 21 April, 1922; Barbour, Brooks and Underwood.

Hellmayr does not recognize this form. I am still, however, inclined to do so.

† Pipra pareolides d'Orbigny and Lafresnaye

= Chiroxiphia lanceolata (Wagler)

Pipra pareolides d'Orbigny and Lafresnaye, Rev. Zoöl., 1838, p. 165.

Cotype.— No. 88,644; Lafresnaye Collection, no. 2,091; "Carthagène."

Cotype.— No. 88,645; Lafresnaye Collection, no. 2,090; "Carthagène."

Pipra lanceolata Wagler, Isis, 1830, p. 931.

The third specimen, Lafresnaye Collection, no. 2,092, a young male, I do not consider a cotype.

Manacus manacus abditivus Bangs

Manacus manacus abditivus Bangs, Proc. New Eng. Zoöl. Club, **1**, 1899, p. 35.

Type.— No. 105,310, ♂; Colombia, Santa Marta; 13 January, 1898; W. W. Brown.

† Manacus candei electilis Bangs

= Manacus candei (Parzudaki)

Manacus candei electilis Bangs, Proc. New Eng. Zoöl. Club, **3**, 1903, p. 105.

Type.— No. 102,469, ♂; Mexico, Vera Cruz, Buena Vista; 10 June, 1901; A. E. Colburn and Percy W. Shufeldt.

Pipra candei Parzudaki, Rev. Zoöl., **4**, 1841, p. 306.

Manacus cerritus Peters

Manacus cerritus Peters, Proc. New Eng. Zoöl. Club, **10**, 1927, p. 9.

Type.— No. 238,477, ♂; Panama, Almirante; 17 June, 1927; H. Wedel.

Manacus vitellinus viridiventris Griscom

Manacus vitellinus viridiventris Griscom, Bull. Mus. Comp. Zoöl., **69**, 1929, p. 179.

Type.— No. 124,545, ♂; Western Colombia, Jiminez; 6 April, 1907; M. G. Palmer

† PTILOCHLORIS REMIGIALIS Lafresnaye

= LANIIOSOMA ELEGANS (Thunberg)

Ptilochloris remigialis Lafresnaye, Rev. Zoöl., 1838, p. 237.

Type.— No. 77,362; Lafresnaye Collection, no. 2,173; (no locality mentioned by Lafresnaye).

Ampelis elegans Thunberg, Dissert. Tullberg, Nov. spec. Ampelis, 1823, p. 2.

Lafresnaye's type has the underparts nearly uniform yellow, with scarcely any black marking, except on the sides. This may represent the plumage of the old adult, but no other specimen in a considerable series of skins is quite like it. See in this connection Sclater, Cat. Birds Brit. Mus, **14**, p. 317.

† MUSCICAPA RUFOOLIVACEUS Lafresnaye

= SCHIFFORNIS TURDINUS TURDINUS (Wied)

Muscicapa rufo-olivaceus Lafresnaye, Mag. Zoöl., 1833, pls. 12, 13, 14, text under "la Gobe-mouche vert Cuvier."

Type.— No. 77,114; Lafresnaye Collection, no. 2,135.

Muscicapa turdinus Wied, Beitr. Naturg. Bras., **3**, 1831, p. 817.

PTILOCHLORIS VIRESCENS Lafresnaye

now SCHIFFORNIS VIRESCENS (Lafresnaye)

Ptilochloris virescens Lafresnaye, Rev. Zoöl., 1838, p. 238.

Type.— No. 77,115; Lafresnaye Collection, no. 2,137.

Lafresnaye's label for his type reads — "Ptilo. virescens nob. le petit, verd. adult," with no locality at all given. A second specimen bears a label which reads, "le Gobe-mouche vert Brèsil les Andes, Mus. Paris." This I do not consider a cotype. A third specimen. Lafresnaye Coll. 2137 bis., entered in Verreaux's Catalogue as *Hetero-pelma virescens*, belongs to another species altogether.

Brabourne and Chubb use the name *Scotothorus unicolor* (Bonaparte) for this species on the grounds that *Muscicapa virescens* Wied was preoccupied, apparently overlooking Lafresnaye's name.

Ptiolchloris virescens Lafresnaye is not invalidated by *Muscicapa virescens* Wied since Lafresnaye independently described this bird using a different generic term. In Mag. Zoöl., 1833, pls. 12, 13 and 14, text, Lafresnaye mentions "Le Gobe-Mouche vert Cuvier Mus. de Paris, Lesson Traité, 391" which he thought had not been described,

but only indicated by Lesson. He did not, however, give it a name until 1838 as cited above. He again referred to "Le Gobe-Mouche vert" in the same number, but, of course, described from his own specimen which becomes the type.

Under the circumstances, I cannot, therefore, agree with Hellmayr that the type is in the Paris Museum.

† Scotothorus veraepacis dumicola Bangs

= Schiffornis turdinus veraepacis (Sclater)

Scotothorus verae-pacis dumicola Bangs, Proc. New Eng. Zoöl. Club, **3**, 1903, p. 103.

Type.— No. 117,849, ♂; Panama, Divala; 2 December, 1900; W. W. Brown.

Heteropelma verae-pacis Sclater, P. Z. S., 1860, p. 300.

Tyrannula pallescens Lafresnaye

now Neopelma pallescens pallescens (Lafresnaye)

Tyrannus pallescens Lafresnaye, Rev. et Mag. Zoöl., 1853, p. 57.

Type.— No. 77,113; Lafresnaye Collection, no. 8,407; "Bahia."

Altogether there are three specimens of this species in the Lafresnaye Collection, no. 8,408 is an immature bird with the crest undeveloped, showing only slight pale yellowish in the middle and so is not a cotype. No. 8,401 listed by Verreaux in his catalogue as *Myiarchus cinereus* Spix, apparently puzzled Lafresnaye, who wrote a lengthy label for it, without making up his mind as to its identity. It also, therefore, is not a cotype.

COTINGIDAE

Tityra semifasciata deses Bangs

Tityra semifasciata deses Bangs, Proc. Biol. Soc. Washington, **28**, 1915, p. 125.

Type.— No. 40,079, ♂; Yucatan, Chichen Itza; 26 February, 1904; L. J. Cole.

† Pachyrhynchus aterrimus Lafresnaye

= Platypsaris niger (Gmelin)

Pachyrhynchus aterrimus Lafresnaye Rev. Zoöl., 1846, p. 320.

Type.— No. 76,374; Lafresnaye Collection, no. 4,479; "Jamaique."

Lanius niger Gmelin, Syst. Nat., 1788, p. 301.

† Pachyrhynchus squamatus Lafresnaye

= Pachyrhamphus versicolor versicolor (Hartlaub)

Pachyrhynchus squamatus Lafresnaye, Rev. Zoöl., 1843, p. 291.

Type.— No. 76,503; Lafresnaye Collection, no. 4,515; "Bogotá."

Vireo versicolor Hartlaub, Rev. Zoöl., 1843, p. 289.

This species Lafresnaye lost by a page priority of two pages.

Pachyrhamphus versicolor costaricensis Bangs

Pachyrhamphus versicolor costaricensis Bangs, Proc. New Eng. Zoöl. Club, **4**, 1908, p. 26.

Type.— No. 117,089, ♂; Costa Rica, Volcan de Irazu; 6 September, 1898; C. F. Underwood.

† Pachyrhamphus notius Brewster and Bangs

= Pachyrhamphus polychopterus spixii (Swainson)

Pachyrhamphus notius Brewster and Bangs, Proc. New Eng. Zoöl. Club, **2**, 1901, p. 53.

Type.— No. 31,130, ♂; Argentina, Entre Rios, Concepcion del Uruguay; 27 November, 1880; W. B. Barrows.

Pachyrynchus spixii Swainson, Anim. Menag., 1837, p. 289, cf. Hellmayr, Field Mus. Public. no. 255, 1929, p. 341.

Pachyrhamphus marginatus nanus Bangs and Penard

Pachyrhamphus marginatus nanus Bangs and Penard, Bull. Mus. Comp. Zoöl., **64**, 1921, p. 395.

Type.— No. 82,600, ♂; East Peru, Xeberos, Peruvian Amazons; Bartlett.

Querula fuscocinerea Lafresnaye

now Lipaugus fuscocinereus (Lafresnaye)

Querula fusco-cinerea Lafresnaye, Rev. Zoöl., 1843, p. 291.

Type.— No. 76,334; Lafresnaye Collection, no. 2,125; "Colombie." A second specimen, no. 2,126, an immature bird, is not a cotype.

Lipaugus simplex frederici Bangs and Penard

now Rhytipterna simplex frederici (Bangs and Penard)

Lipaugus simplex frederici Bangs and Penard, Bull. Mus. Comp. Zoöl., **62**, 1918, p. 71.

Type.— No. 80,922, ♂; Surinam, vicinity of Paramaribo; 6 June, 1913; T. E. Penard Collection.

Attila flammulatus Lafresnaye

now Attila spadiceus flammulatus (Lafresnaye)

Attila flammulatus Lafresnaye, Rev. Zoöl., 1848, p. 47.

Type.— No. 76,375; Lafresnaye Collection, no. 4,526; "Colombie" (error=Vera Cruz, Mexico, cf. Bangs and Penard, Proc. Biol. Soc. Washington, **35**, 1922, p. 223).

† Phoenicircus atrococcineus Lafresnaye

= Phoenicircus nigricollis Swainson

Phoenicircus atro-coccineus Lafresnaye, Rev. Zoöl., 1838, p. 236.

Type.— No. 83,868; Lafresnaye Collection, no. 2,071; "Perou."

Phoenicircus nigricollis Swainson, Fauna Bor. Am. 2, 1831, p. 491.

Ampelis arcuata Lafresnaye

now Euchlornis arcuata (Lafresnaye)

Ampelis arcuata Lafresnaye, Rev. Zoöl., 1843, p. 98. *Cotinga arcuata*, Mag. Zoöl., 1843, pl. 40.

Type.— No. 76,339; Lafresnaye Collection, no. 2,163; "Colombie."

Lafresnaye also had in his cabinet two females, one adult, one young, but as he described only the males, these are, of course, not cotypes.

Ampelis aureopectus Lafresnaye

now Euchlornis aureopectus aureopectus Lafresnaye

Ampelis aureo-pectus Lafresnaye, Rev. Zoöl., 1843, p. 68. Mag. Zoöl., 1843, pl. 39.

Cotype.— No. 76,336; Lafresnaye Collection, no. 2,166, "♂; Colombie."

Cotype.— No. 76,338; Lafresnaye Collection, no. 2,168, "♀; Colombie."

Another male in the collection is not a cotype.

Pipreola aureopectus decora Bangs

now Euchlornis aureopectus decora (Bangs)

Pipreola aureopectus decora Bangs, Proc. Biol. Soc. Washington, **13**, 1899, p. 98.

Type.— No. 106,173, ♂; Colombia, Santa Marta Mountains, Chirua; 12 February, 1899; W. W. Brown.

Ampelis lamellipennis Lafresnaye

now Xipholena lamellipennis (Lafresnaye)

Ampelis lamellipennis Lafresnaye, Mag. Zoöl., 1839, pl. 9, text and plate. (No locality given — Brazil designated by Brabourne and Chubb).

Type.— No. 84,333; Lafresnaye Collection, no. 2,192.

The type is a fine old adult male with a pure white tail.

In the same article (*supra*) Lafresnaye gave a name — *Ampelis leucura* ex. Temminck—to the immature bird of this species with dark spots in the tail; the type is in the Paris Museum.

Coracina granadensis Lafresnaye

now Pyroderus scutatus granadensis (Lafresnaye)

Coracina Granadensis Lafresnaye, Rev. Zoöl., 1846, p. 277.

Type.— No. 76,205; Lafresnaye Collection, no. 2,140; "Nouvelle grenade."

Coracina orenocensis Lafresnaye

now Pyroderus scutatus orenocensis (Lafresnaye)

Coracina orenocensis Lafresnaye, Rev. Zoöl., 1846, p. 277.

Type.— No. 76,206; Lafresnaye Collection, no. 2,139; "bouches de l'orinoque."

PITTIDAE

Pitta piroensis Muir and Kershaw

Pitta piroensis Muir and Kershaw, Proc. Biol. Soc. Washington, **13**, 1910, p. 65.

Type.— No. 49,997; Ceram, Piroe; 2 March, 1909.

XENICIDAE

†Acanthiza tenuirostris Lafresnaye

= Acanthisitta chloris chloris (Sparrman)

Acanthiza tenuirostris Lafresnaye, Rev. Zoöl., 1841, p. 242.

Type.— No. 84,371; Lafresnaye Collection, no. 2,718; "Nlle. Zela." (= South Island).

Sitta chloris Sparrman, Mus. Carlson, fasc. 2, 1787, no. 33.

HIRUNDINIDAE

Cotile fohkienensis La Touche

now Riparia riparia fohkienensis (La Touche)

Cotile fohkienensis La Touche, Bull. B. O. C., **22**, 1908, p. 17.

Cotype.— No. 130,235, ♂; Northwest Fohkien, Shaowufu; 30 November, 1895; La Touche Collection.

Cotype.— No. 130,236, ♀; Fohkim, Foochow; February, 1896; La Touche Collection.

Tachycineta thalassina brachyptera Brewster

Tachycincta thalassina brachyptera Brewster, Bull. Mus. Comp. Zoöl., **41**, 1902, p. 167.

Type.— No. 215,406, ♂; Lower California, Sierra de la Laguna; 6 June, 1887; M. A. Frazar.

Hirundo cyaneoviridis Bryant

now Callichelidon cyaneoviridis (Bryant)

Hirundo cyaneoviridis Bryant, Proc. Bost. Soc. N. H., **7**, 1859, p. 111.

Cotype.— No. 46,838, ♂; Bahamas, Nassau; H. Bryant.

Cotype.— No. 46,840, ♂; Bahamas, Nassau; 17 April; H. Bryant.

Cotype.— No. 46,841, ♂; Bahamas, Nassau; 12 April; H. Bryant.

Three other cotypes are known to me, one each in collection of John E. Thayer, Lancaster, Mass.; United States National Museum; and Academy of Natural Sciences of Philadelphia.

Hirundo abyssinica Guérin

now Hirundo abyssinica abyssinica Guérin

Hirundo abyssinica Guérin, Rev. Zoöl., 1843, p. 322.

Type.— No. 76,077; Lafresnaye Collection, no. 946; label, "hir. abyssinica Guér. nob. rev., 1843, p. 322 (Abyssinie)."

The name *Hirundo puella* Temminck and Schlegel has for a long time been used for this species, 1842 being taken as the date of publication of the part of Fauna Japonica in which it appeared. Messrs. C. D. Sherborn and F. A. Jentink (P. Z. S., 1895, p. 149) have, however, shown that 1847, not 1842, was the actual date of publication, and, therefore, Guérin's name must be used for the species, instead of Temminck and Schlegel's.

The forms recognized by Sclater and Mackworth-Praed (Ibis, 1918, pp. 718, 719) should thus be called —

1. *Hirundo abyssinica abyssinica* Guérin.
2. *Hirundo abyssinica puella* Temminck and Schlegel.
3. *Hirundo abyssinica unitatis* Sclater and Mackworth-Praed.

Progne subis hesperia Brewster

Progne subis hesperia Brewster, Auk, **6**, 1889, p. 92 (separates issued in advance, 31 January, 1889).

Cotype.— No. 215,394, ♂; Lower California, Sierra de la Laguna; 4 June, 1887; M. A. Frazar.

Cotype.— No. 215,395, ♀; Lower California, Sierra de la Laguna; 4 June, 1887; M. A. Frazar.

Petrochelidon fulva cavicola Barbour and Brooks

Petrochelidon fulva cavicola Barbour and Brooks, Proc. New Eng. Zoöl. Club, **6**, 1917, p. 52.

Type.— No. 67,675, ♂; Cuba, San Antonio de los Baños; 22 March, 1915; Barbour, Brooks and Rodriguez.

Stelgidopteryx ruficollis cacabatus Bangs and Penard

Stelgidopteryx ruficollis cacabatus Bangs and Penard, Bull. Mus. Comp. Zoöl., **62**, 1918, p. 83.

Type.— No. 80,924, ♂; Surinam, vicinity of Paramaribo; 19 June, 1913; E. Graanoogst.

Stelgidopteryx ruficollis aequalis Bangs

Stelgidopteryx ruficollis aequalis Bangs, Proc. New Eng. Zoöl. Club, **2**, 1901, p. 58.

Type.— No. 105,458, ♂; Colombia, Santa Marta; 20 January, 1898; W. W. Brown.

Stelgidopteryx ruficollis decolor Griscom

Stelgidopteryx ruficollis decolor Griscom, Proc. New Eng. Zoöl. Club, **11**, 1929, p. 69.

Type.— No. 107,641, ♂; Panama, Divala; 1 December, 1900; W. W. Brown.

Stelgidopteryx ruficollis psammochrous Griscom

Stelgidopteryx ruficollis psammochrous Griscom, Proc. New Eng. Zoöl. Club, **11**, 1929, p. 72.

Type.— No. 221,956, ♂; Mexico, Sonora, near Oposura; 15 April, 1887; John C. Cahoon.

MUSCICAPIDAE

Hemichelidon sibirica incerta La Touche

now Muscicapa sibirica incerta (La Touche)

Hemichelidon sibirica incerta La Touche, Handbook, Birds of Eastern China, pt. 2, 1925, p. 159.

Type.— No. 128,445, ♂; Northeast Chihli, Chinwangtao; 28 May, 1911; La Touche Collection.

Cyornis tickelliæ glaucicomans Thayer and Bangs

now Muscicapa rubeculoides glaucicomans (Thayer and Bangs)

Cyornis tickelliae glaucicomans Thayer and Bangs, Bull. Mus. Comp. Zoöl., **52**, 1909, p. 141.

Type.— No. 50,003, ♂; Hupeh, Tanshuiya; 7 May, 1907; W. R. Zappey.

Cyanoptila cumatilis Thayer and Bangs

now Muscicapa cyanomelana cumatilis (Thayer and Bangs)

Cyanoptila cumatilis Thayer and Bangs, Bull. Mus. Comp. Zoöl., **52**, 1909, p. 141.

Type.— No. 50,004, ♂; Hupeh, Mafuling; 14 May, 1907; W. R. Zappey.

Zanthopygia owstoni Bangs

now Muscicapa narcissina owstoni (Bangs)

Zanthopygia owstoni Bangs, Bull. Mus. Comp. Zoöl., **36**, 1901, p. 265.

Type.— No. 37,367, ♂; Loochoo Islands, Ishigaki; 20 June, 1899; I. Zensaku.

† Muscicapa rufula Lafresnaye

= Ochromela nigrorufa (Jerdon)

Muscicapa rufula Lafresnaye, Rev. Zoöl., 1840, p. 66.

Cotype.— No. 77,253; Lafresnaye Collection, no. 4,185; India, Nilgheries.

Cotype.— No. 77,254; Lafresnaye Collection, no. 4,186; India, Nilgheries.

Saxicola nigrorufa Jerdon, Madr. Jour., L. S. **10**, 1839, p. 266.

† Muscicapa fumigata Guérin

= Dioptrornis chocolatinus chocolatinus (Rüppell)

Muscicapa fumigata Guérin, Rev. Zoöl., 1843, p. 161.

Type.— No. 76,036; Lafresnaye Collection, no. 4,169; "Abyssinie."

Muscicapa chocolatinus Rüppell, Neue Wirbelthiere, 1835, p. 107.

Siphia brunneata Slater

now Rhinomyias olivacea brunneata (Slater)

Siphia brunneata Slater, Ibis, 1899, p. 422.

Cotype.— No. 128,548, ♂; Fohkien, Kuatun; 26 May, 1896; La Touche Collection.

La Touche thinks that this skin is the actual type, but as no holotype was designated by Slater, I considered it and all the specimens Slater had at the time he described the form, cotypes.

Anthipes laurentii La Touche

Anthipes laurentii La Touche, Bull. B. O. C., **42**, 1921, p. 15.

Cotype.— No. 128,546, ♂; Yunnan, Loukouchai; 11 April, 1921; La Touche Collection.

Cotype.— No. 128,547, ♀; Yunnan, Mengtsz; 9 October, 1920; La Touche Collection.

Niltava grandis griseiventris La Touche

Niltava grandis griseiventris La Touche, Bull. B. O. C., **42**, 1921, p. 14.

Type.— No. 128,556, ♂; Yunnan, Loukouchai; 7 April, 1921; La Touche Collection.

Niltava sundara denotata Bangs and Phillips

Niltava sundara denotata Bangs and Phillips, Bull, Mus. Comp. Zoöl., **58**, 1914, p. 280.

Type.— No. 61,905, ♂; Yunnan, Mengtsz; 14 October, 1910; Kobayashi Collection.

Niltava davidi La Touche

now Niltava davidi davidi La Touche

Niltava davidi La Touche, Bull. B. O. C., **21**, 1907, p. 18.

Cotype.— No. 128,569, ♂; Northwest Fohkien, Kuatun; 11 April, 1898; La Touche Collection.

Cotype.— No. 128,570, ♀; Northwest Fohkien, Kuatun; 15 April; 1897; La Touche Collection.

Niltava lychnis Thayer and Bangs

now Niltava davidi lychnis Thayer and Bangs

Niltava lychnis Thayer and Bangs, Bull. Mus. Comp. Zoöl., **52**, 1909, p. 41.

Type.— No. 50,001, ♂; Hupeh, Paotung; 19 May, 1907; W. R. Zappey.

Parisoma galinieri Guérin

now Parophasma galinieri (Guérin)

Parisoma Galinieri Guérin, Rev. Zoöl., 1843, p. 162.

Type.— No. 76,047; Lafresnaye Collection, no. 3,407; "Abyssinie Guér. nob."

In Ferret and Galinier Voyage en Abyssinie (p. 225) Guérin and Lafresnaye make the following statement — "Quoique le seul individu qui ait été rapporté ait le bec troqué et qu'il soit en pleine mue n'ayant qu'une partie de ses remiges et de ses rectrices on reconnaît qu'il appartient au genre Parisoma. . . ."

The type agrees with what they say in having a broken upper man-

dible and several tail-feathers and most of the primaries missing.

Prêtre, however, in depicting the bird in the *Atlas* restored these parts.

Parisoma pulpum Friedmann

Parisoma pulpum Friedmann, Occ. Papers Bost. Soc. N. H., **5**, 1926, p. 219.

Type.— No. 94,824, ♂; Portuguese Guinea, Gunnal; 28 May, 1909; W. J. Ansorge.

Parisoma böhmi somalicum Friedmann

Parisoma böhmi somalicum Friedmann, Proc. New Eng. Zoöl.Club, **10**, 1928, p. 51.

Type.— No. 234,932, ♂; British Somaliland, Sok Soda; 22 February, 1899; E. Lort Phillips.

Hypothymis aeria Bangs and Peters

Hypothymis aeria Bangs and Peters, Occ. Papers, Bost. Soc. N. H., **5**, 1927, p. 237.

Type.— No. 235,918, ♂; Maratua Island, off east coast of Borneo; March, 1926; E. Mjöberg.

Rhipidura flabellifera penitus Bangs

now Rhipidura fuliginosa penitus Bangs

Rhipidura flabellifera penitus Bangs, Proc. Biol. Soc. Washington, **24**, 1911, p. 41.

Type.— No. 39,984, ♀; Chatham Island; received from H. H. Travers.

Tchitrea ferreti Guérin

now Tchitrea viridis ferreti (Guérin)

Tchitrea Ferreti Guérin, Rev. Zoöl., 1843, p. 162.

Cotype.— No. 76,037; Lafresnaye Collection, no. 4,307; "Abyssinie."

Cotype.— No. 76,038; Lafresnaye Collection, no. 4,308; "Abyssinie."

There are in all five examples in the Lafresnaye Collection, but as Guérin originally described only the adult male, I consider only the two adult males to be cotypes. The other specimens are: Lafr. coll. 4,309 (M.C.Z., 76,039) immature ♂; Lafr. coll. 4,300 (M. C. Z. 76,040) adult ♀; and Lafr. coll. 4,311 (M. C. Z. 84,643), immature.

The two birds figured in the *Atlas* (Ferret et Galinier Voy. en Abyssinie) are easily identified in the series, and are M. C. Z. 76,038 adult ♂ and M. C. Z. 76,040, adult ♀.

Terpsiphone illex Bangs

now Tchitrea atrocaudata illex (Bangs)

Terpsiphone illex Bangs, Bull. Mus. Comp. Zoöl., **36**, 1901, p. 264.

Type.— No. 37,363, ♂; Loochoo Islands, Ishigaki; 25 April, 1899, I. Zensaku.

Platyrhynchus albiventris Peale

now Myiagra albiventris (Peale)

Platyrhynchus albiventris Peale, U. S. Expl. Exped., 1848, p. 102.

Cotype.— No. 75,817; Samoan Islands; U. S. Expl. Exped.

Peale does not say how many examples he secured, undoubtedly there are other cotypes than ours.

CAMPOPHAGIDAE

Pericrocotus speciosus bakeri La Touche

Pericrocotus speciosus bakeri La Touche, Bull. B. O. C., **42**, 1921, p. 55.

Cotype.— No. 130,046, ♂; Yunnan, Loukouchai; February, 1921; La Touche Collection.

Cotype.— No. 130,047, ♀; Yunnan, Mengtsz.; 28 November, 1920; La Touche Collection.

Rothschild relegated La Touche's *bakeri* to the synonymy of *speciosus speciosus* (Nov. Zoöl., **32**, 1925, p. 305); but Kinnear (Ibis, 1929, p. 139) thinks it probably will prove to be a valid form.

Pericrocotus brevirostris ethologus Bangs and Phillips

Pericrocotus brevirostris ethologus Bangs and Phillips, Bull. Mus. Comp. Zoöl., **58**, 1914, p. 283.

Type.— No. 51,487, ♂; Hupeh, Hsienshan; 28 May, 1907; W. R. Zappey.

PERICROCOTUS BREVIROSTRIS FLAVILLACEUS Bangs and Phillips

now PERICROCOTUS BREVIROSTRIS FAVILLACEUS (Bangs and Phillips)

("Flavillaceus," as I have already pointed out, is a misprint for "*favillaceus*").

Pericrocotus brevirostris flavillaceus Bangs and Phillips, Bull. Mus. Comp. Zoöl., **58**, 1914, p. 283.

Type.— No. 24,146; Northern India, Koolloo Valley; Rev. M. M. Carleton.

After again carefully going over the question of the races of *P. brevirostris* I cannot bring myself to follow the arrangement used by Stuart Baker (Fauna of Brit. India, Birds, **2**, 1924, p. 323) and adopted by Rothschild (Nov. Zoöl., **33**, 1926, p. 297), but still adhere to that used by Phillips and myself (Bull. Mus. Comp. Zoöl., **58**, 1914, p. 283). When I was last in the British Museum, Kinnear and I, at his suggestion, spent half a day with the superb series of this species, contained in the collection, and with the whole literature bearing on the subject, the result being that when we had finished Kinnear wholly agreed with me (see also Kinnear, Ibis, 1929, p. 138).

Vigors in describing his *Muscicapa brevirostris* (P. Z. S., 1831, p. 43) gives no locality whatsoever for it, except to say "Himalayan birds" in the first lines of his article. His diagnosis is too general to apply to one subspecies rather than another. But Gould (Cent. Himal. Birds, plate 8) later figured the type, now apparently lost, and Gould's figure *certainly does not* represent the pale, pinkish red form of northern India — *favillaceus* — but shows an intensely colored bird, exactly what Stuart Baker calls *affinis* McClellan.

I have carefully read Ticehurst and Whistler, Ibis, 1924, p. 468–473, on the Vigors types, with much interest, but I still believe that the forms must be identified, when possible, by the Gould plates. In this opinion Rothschild agrees, in Avifauna of Yunnan, 1926, p. 239, where he points out that Gould's figure of the woodpecker — *Dryobates hyperythrus* — does not agree with the west Himalayan form, and, therefore, contrary to the opinion of Ticehurst and Whistler, who name the eastern form *sikhimensis*, retains *D. hyperythrus hyperythrus* (Vigors) for the eastern form, and *D. hyperythrus marshalli* Hartert, for the western. I have also compared Gould's figure with ample material of this woodpecker and am wholly in accord with Rothschild's views. Having done this in the case of the woodpecker, I was rather surprised that Rothschild followed exactly the opposite course in the case of the minivet.

† Pericrocotus cinereus Lafresnaye

= Pericrocotus divaricatus (Raffles)

Pericrocotus cinereus Lafresnaye, Rev. Zoöl., 1845, p. 94.

Type.— No. 77,145; Lafresnaye Collection, no. 5,249; "île de luçon (Philippines)."

Lanius divaricatus Raffles, Transactions Linnaean Soc., March–May, 1822, p. 306.

Lalage niger mitifica Bangs

Lalage niger mitifica Bangs, Bull. Mus. Comp. Zoöl., **65**, 1922, p. 80.

Type.— No. 64,329, ♂; Philippines, Lubang near Luzon; 6 July, 1913; Gov. W. Cameron Forbes.

L. n. schisticeps Neumann (Jour. f. Orn., **67**, 1919, p. 333) from Culion Island is an artifact, the body being that of a cuckoo-shrike and the head that of a *Pericrocotus divaricatus* (c/ o Stresemann, Orn. Monats., **30**, 1922, p. 88). This name has been lately used for the Philippine form by Kloss, Journal Malayan Branch Royal Asiatic Society, **4**, 1926, p. 158) who discusses at length the whole question.

I know that there is no rule against using a name based on an artifact, and that there are all degrees of artifacts from those in which the preparator has inserted a few feathers to cover a bare spot, to one like the present one, where the head of one genus is placed upon the body of another. I cannot accept a name based on such a combination, and it seems to me a case where the name must be restricted to one or the other of the two constituent parts. As, therefore, the specific name used by Neumann referred to the color of the head, I restrict it to the species whose head appeared in the artifact, that is to *Pericrocotus divaricatus* (Raffles).

PYCNONOTIDAE

Aegithina tiphia styani La Touche

Aegithina tiphia styani La Touche, Bull. B. O. C., **43**, 1923, p. 174.

Type.— No. 130,271, ♂; Yunnan, Szemao; La Touche Collection.

Aegithina tiphia aequanimis Bangs

Aegithina tiphia aequanimis Bangs, Bull. Mus. Comp. Zoöl., **65**, 1922, p. 81.

Type.— No. 64,334,♂; Philippines, Palawan Island, Puerto Princesa; 4 August, 1913; Gov. W. Cameron Forbes.

† HARINGTONIA PERNIGER SINENSIS La Touche

= MICROSCELIS LEUCOCEPHALUS LEUCOCEPHALUS (Gmelin)

Haringtonia perniger sinensis La Touche, Bull. B. O. C., **42**, 1921, p. 53.

Type.— No. 130,315, ♂; Yunnan, Hokou; 15 March, 1921; La Touche Collection.

Turdus leucocephalus Gmelin, Syst. Nat., **1**, 1789, p. 826.

La Touche stoutly maintains that his black form is really distinct from the white-headed *leucocephalus*. On the other hand both Stresemann and Rothschild, consider *sinensis* to be merely the wholly black phase of the very variable *leucocephalus leucocephalus*. I have examined a very large series of skins from many parts of China, and agree with Stresemann and Rothschild.

† HARINGTONIA LEUCOCEPHALUS MONTIVAGUS Bangs and Penard

= MICROSCELIS LEUCOCEPHALUS LEUCOCEPHALUS (Gmelin)

Haringtonia leucocephalus montivagus Bangs and Penard, Proc. New Eng. Zoöl. Club, **8**, 1923, p. 41.

Type.— No. 88,242, ♂; Fuhkien, Yenping Mountains; 23 April, 1921; H. R. Caldwell.

Turdus leucocephalus Gmelin, Syst. Nat., **1**, 1789, p. 826.

Penard and I described this form, because the Rév. Harry R. Caldwell, who sent us a pair, assured us that in his experience in the field it was a mountain form quite distinct from *M. leucocephalus leucocephalus*. The male is black all over with a sharply defined narrow white frontal band; the female is black above and grayish black, slightly mixed with gray on the belly below, the white frontal band indicated by scattered white feathers. I now consider this another phase of the variable *leucocephalus* rather than a distinct mountain form as Caldwell believed it to be.

MICROTARSUS HODIERNUS Bangs and Peters

Microtarsus hodiernus Bangs and Peters, Occ. Papers, Bost. Soc. N. H., **5**, 1927, p. 238.

Type.— No. 235,902, ♂; Maratua Island, off east coast of Borneo; February-March, 1926; E. Mjöberg.

Tricophorus calurus Cassin

now Criniger calurus (Cassin)

Tricophorus calurus Cassin, Proc. Acad. Nat. Sci. Phila., 1856, p. 158.

Cotype.— No. 17,660; West Africa, Muni River; DuChaillu.

This skin, which came to the M. C. Z. years ago with that part of the Cassin Collection which went originally to Brown University, is one of three cotypes, the other two are in the Academy of Natural Sciences of Philadelphia.

† Trichophorus caniceps Lafresnaye

= Alophoixus phaeocephalus (Hartlaub)

Trichophorus caniceps Lafresnaye, Rev. Zoöl., 1845, p. 367.

Type.— No. 84,380; Lafresnaye Collection, no. 3,446; "Borneo, malacca."

Ixos (*Trichixos* Less.) *phaeocephalus* Hartlaub, Rev. Zoöl., 1844, p. 401.

Lafresnaye had two specimens for which he wrote exactly similar labels, and identified as belonging to the same species. The other, no. 84,379, Lafresnaye Collection, no. 3,445, has conspicuous yellow tips to the rectrices and is *Criniger diardii* Finsch. Had Lafresnaye described this example his name would have held, but he did not, and his name is based wholly on the individual with a plain tail and therefore falls as a synonym of Hartlaub's *phaeocephalus*.

† Alcurus striatus paulus Bangs and Phillips

= Alcurus striatus (Blyth)

Alcurus striatus paulus Bangs and Phillips, Bull. Mus. Comp. Zoöl., **58**, 1914, p. 284.

Type.— No. 62,006, ♂; Yunnan, Loukouchai; 5 February, 1911; Kobayashi Collection.

Trichophorus striatus Blyth, Journ. As. Soc. Bengal, **11**, 1842, p. 184.

Rothschild has conclusively shown (Novit. Zoöl., **28**, 1921, p. 51) that there is no difference in size between birds from Sikkim on the one hand and those from Burma and Yunnan on the other, and therefore *paulus* goes.

Pycnonotus sinensis stresemanni La Touche

Pycnonotus sinensis stresemanni La Touche, Handbook Birds of Eastern China, pt. 1, 1925, p. 94.

Type.— No. 130,405, ♂; Northwestern Fohkien, below Kuatun; 28 April, 1898; La Touche Collection.

† Ixos plumigerus Lafresnaye

= Molpastes leucogenys leucogenys (Gray and Hardwicke)

Ixos plumigerus Lafresnaye, Rev. Zoöl., 1840, p. 228.

Type.— No. 84,377; Lafresnaye Collection, no. 3,478; "Nlle. holl. ou indes."

Brachypus leucogenys Gray and Hardwicke, Ill. Ind. Zoöl., **1**, pl. 3, fig. 3.

The type of *Haematornis chrysorrhoides* Lafresnaye, now *Molpastes haemorrhous chrysorrhoides* (Lafresnaye), should, I suppose, be in the Lafresnaye Collection, but I have been wholly unable to find it, or to trace it by Lafresnaye's written labels.

Spizixus canifrons ingrami Bangs and Phillips

Spizixus canifrons ingrami Bangs and Phillips, Bull. Mus. Comp. Zoöl., **58**, 1914, p. 285.

Type.— No. 62,008, ♂; Yunnan, Mengtsz; 18 March, 1911; Kobayashi Collection.

Rothschild (Nov. Zoöl., **28**, 1921, p. 50) attempts to disprove this form on the grounds that its characters are simply those of immaturity. This is out of the question. I have before me now a series of sixteen skins from southern Yunnan, that includes juvenals, immatures and adults, many of the latter in worn breeding plumage. All the adults are similar, and all differ from *S. canifrons canifrons* in having pure gray, not brownish, throats and cheeks, and in the slightly different color of the under parts. The bird of western Yunnan is, of course, *S. c. canifrons*, but the form inhabiting the region about Mengtsz is perfectly distinct and must stand.

TIMELIIDAE

† Orthonyx icterocephalus Lafresnaye

= Mohua ochrocephala (Gmelin)

Orthonyx icterocephalus Lafresnaye, Rev. Zoöl., 1839, p. 257. Figured as *Orthonyx heteroclytus* Lafresnaye, Mag. Zoöl., 1839, pl. 8.

Type.— No. 76,252; Lafresnaye Collection, no. 2,497; "Nlle. Zelande."

Muscicapa ochrocephala Gmelin, Syst. Nat., 1789, p. 944.

Lafresnaye had another specimen, no. 2,496, probably acquired later than the type, for which he wrote a wholly different label.

In the original description the locality is given as "in insulis les Marquises dictis," but on the label of the type Lafresnaye wrote "Nlle. Zelande."

Ianthocincla davidi experrecta Bangs and Peters

now Garrulax davidi experrecta (Bangs and Peters)

Ianthocincla davidi experrecta Bangs and Peters, Bull. Mus. Comp. Zoöl., **68**, 1928, p. 339.

Type.— No. 238,760, ♀; western Kansu, Liyuanku, Richthofen Range; November, 1925; J. F. Rock.

Ianthocincla elliotii perbona Bangs and Peters

now Garrulax elliotii perbona (Bangs and Peters)

Ianthocincla elliotii perbona Bangs and Peters, Bull. Mus. Comp. Zoöl., **68**, 1928, p. 340.

Type.— No. 238,772, ♂; western Kansu, Liyuanku, Richthofen Range; November, 1925; J. F. Rock.

Trochalopteron phoeniceum wellsi La Touche

now Garrulax phoenicea wellsi (La Touche)

Trochalopterum phoeniceum wellsi La Touche, Bull. B. O. C., **42**, 1921, p. 15.

Type.— No. 126,650, ♀; Yunnan, Mengtsz; 21 February, 1921; La Touche Collection.

† Ianthocincla lustrabila Bangs and Phillips

= Garrulax milnei sharpei (Rippon)

Ianthocincla lustrabila Bangs and Phillips, Bull. Mus. Comp. Zoöl., **58**, 1914, p. 285..

Type.— No. 62,014, ♂; Yunnan, Loukouchai; 5 February, 1911; Kobayashi Collection.

Trochalopteron sharpei Rippon, Bull. B. O. C., **12**, 1901, p. 13.

† Crateropus delessertii Lafresnaye

= Garrulax cachinnans cachinnans (Jerdon)

Crateropus delessertii Lafresnaye, Rev. Zoöl., 1840, p. 55. (Not *Crateropus delesserti* Jerdon, Madr. Jour., **10**, 1839, p. 256.)

(*Crateropus lafresnayii* Delessert to replace *C. delessertii* Lafresnaye, preoccupied.)

Cotype.— No. 84,374; Lafresnaye Collection, no. 5,482; "neelgheries."

Cotype.— No. 84,375; Lafresnaye Collection, no. 5,483; "neelgheries."

Crateropus cachinnans Jerdon, Madr. Jour, **10**, 1839, p. 255, pl. 7.

† Trochalopterum canorum yunnanensis La Touche

= Garrulax canora canora (Linné)

Trochalopterum canorum yunnanensis La Touche, Bull. B. O. C., **42**, 1921, p. 52. (Not *Trochalopteron yunnanensis* Rippon, Bull. B. O. C., **19**, 1906, p. 32.)

Trochalopterum canorum namtiense La Touche, Ibis, 1923, p. 317, new name for *Trochalopterum canorum yunnanensis* La Touche, preoccupied.

Type.— No. 126,662, ♂; Yunnan, Hokow; 4 February, 1921; La Touche Collection.

Turdus canorus Linné, Syst. Nat., ed. 10, 1758, p. 169.

Kinnear (Ibis, 1929, p. 145) has questioned La Touche's *namtiense*, saying he can see no difference between birds from south China and those from Tonkin. I quite agree. Recently made skins from south China, Yunnan and Tonkin are, so far as I can see, quite alike. Old museum specimens become much more reddish, and I am almost certain that La Touche compared new Yunnan material with skins from Fohkien that had lain in his cabinet for years. Already skins collected by Zappey in 1907 and 1908 are much more reddish, less olivaceous than some from the same general region recently collected.

† Dryonastes chinensis lowei La Touche

= Garrulax chinensis chinensis (Scopoli)

Dryonastes chinensis lowei La Touche, Bull. B. O. C., **42**, 1921, p. 52.

Type.— No. 126,797, ♂; Yunnan, Hokow; 27 March, 1921; La Touche Collection.

Lanius chinensis Scopoli, Del. Flor. et Faun. Insubr., **2**, 1786, p. 86.

I wholly agree with Kinnear (Ibis, 1929, p. 146) that this supposed form cannot stand. Comparison with a very long series from Tonkin shows that the characters that were thought to separate it are wholly due to individual variation.

† Timalia poecilorhyncha Lafresnaye
= Argya subrufa (Jerdon)

Timalia poecilorhyncha Lafresnaye, Rev. Zoöl., 1840, p. 65.

Type.— No. 84,373; Lafresnaye Collection, no. 5,487; "hymalaya, Plateau des neelgheries."

Timalia subrufa Jerdon, Madr. Jour., **10**, 1839, p. 259.

Pomatorhinus ruficollis reconditus Bangs and Phillips

Pomatorhinus ruficollis reconditus Bangs and Phillips, Bull. Mus. Comp. Zoöl., **58**, 1914, p. 286.

Type.— No. 62,046, ♂; Yunnan, Mengtsz; 22 November, 1910; Kobayashi Collection.

Pomatorhinus ruficollis albipectus La Touche

Pomatorhinus ruficollis albipectus La Touche, Handb. Birds East. China, pt. **1**, 1925, p. 69.

Type.— No. 126,737, ♂; Yunnan, Szemao; 1 January, 1923; E. P. Laurente.

Pomatorhinus ruficollis laurentii La Touche

Pomatorhinus ruficollis laurentii La Touche, Bull. B. O. C., **42**, 1921, p. 16.

Type.— No. 126,734, ♂; Yunnan, Kopaotsun; 15 May, 1921; La Touche Collection.

Pomatorhinus macclellandi odicus Bangs and Phillips

Pomatorhinus macclellandi odicus Bangs and Phillips, Bull. Mus. Comp. Zoöl., **58**, 1914, p. 286.

Type.— No. 61,999, ♂; Yunnan, Mengtsz; 22 June, 1911; Kobayashi Collection.

Turdoides melanops ater Friedmann
now Turdoides hartlaubi ater Friedmann

Turdoides melanops ater Friedmann, Proc. New Eng. Zoöl. Club, **10**, 1927, p. 11.

Type.— No. 239,550, ♂; Belgian Congo, Kamaniola; 2 February, 1927; D. H. Linder.

Pyctorhis sinensis major La Touche

Pyctorhis sinensis major La Touche, Handb. Birds of East. China, pt. 1, 1925, p. 72.

Type.— No. 126,841, ♂; Yunnan, Mengtsz; 1 March, 1921; La Touche Collection.

La Touche assumes the type locality of *Parus sinensis* Gmelin to be the Indo-Burmese countries, and separates under the above name the rather larger Yunnan bird.

Pellorneum ruficeps vividum La Touche

Pellorneum ruficeps vividum La Touche, Bull. B. O. C., **42**, 1921, p. 17.

Cotype.— No. 126,834, ♂; Yunnan, Hokow; 31 March, 1921; La Touche Collection.

Cotype.— No. 126,835, ♀; Yunnan, Hokow; 31 March, 1921; La Touche Collection.

Bernieria madagascariensis inceleber Bangs and Peters

Bernieria madagascariensis inceleber Bangs and Peters, Proc. New Eng. Zoöl., Club, **9**, 1926, p. 43.

Type.— No. 78,115,♂; Western Madagascar, Bemara Gorges, Upper Siribihina River; 3 July, 1915; F. R. Wulsin.

In our description of this strongly marked subspecies the name Bernieria was by a typographical error printed "Berneria." As so often happens neither Peters nor I noticed this until the article appeared, when both of us at once saw the mistake!

Alcippe nipalensis schaefferi La Touche
now Alcippornis nipalensis schaefferi (La Touche)

Alcippe nipalensis schaefferi La Touche, Bull. B. O. C., **42**, 1922, p. 81.

Type.— No. 126,857, ♂?; Yunnan, Milati; January, 1921; La Touche Collection.

Fulvetta cinereiceps fessa Bangs and Peters

Fulvetta cinereiceps fessa Bangs and Peters, Bull. Mus. Comp. Zoöl., **68**, 1928, p. 342.

Type.— No. 238,787, ♂; southwest Kansu, Choni spruce forests, Tao River basin; February, 1926; J. F. Rock.

Stachyris nigriceps yunnanensis La Touche

Stachyris nigriceps yunnanensis La Touche, Bull. B. O. C., **42**, 1921, p. 18.

Type.— No. 126,964; Yunnan, Hokow; 2 April, 1921; La Touche Collection.

Stachyridopsis ruficeps bangsi La Touche

Stachyridopsis ruficeps bangsi La Touche, Bull. B. O. C., **44**, 1923, p. 32.

Type.— No. 126,971, ♂?; Yunnan, Milati; 9 February, 1921; La Touche Collection.

† Myiophonus brevirostris Lafresnaye

= Myiophonus caeruleus caeruleus (Scopoli)

Myiophonus Brevirostris Lafresnaye, Rev. Zoöl., 1852, p. 460.

Cotype.— No. 76,260; Lafresnaye Collection, no. 3,404; "Chine."
Cotype.— No. 76,261; Lafresnaye Collection, no. 3,405.

Gracula caerulea Scopoli, Del. Flor. et Faun. Insubr., **2**, 1786, p. 88, no. 42.

Lafresnaye wrote one label for these two specimens, as he often did when he had more than one specimen of a species. He, however, mentions having compared his two examples with two of *M. temminckii* which, of course, makes the two cotypes.

Myophonus caeruleus immansuetus Bangs and Penard

Myophonus caeruleus immansuetus Bangs and Penard, Occ. Papers Bost. Soc. N. H., **5**, 1925, p. 147.

Type.— No. 50,653, ♂; Ichang, Hupeh; 28 March, 1907; W. R. Zappey.

Heteroxenicus cruralis formaster Thayer and Bangs

now Brachypteryx cruralis formaster (Thayer and Bangs)

Heteroxenicus cruralis formaster Thayer and Bangs, Mem. Mus. Comp. Zoöl., **40**, no. 4, 1912, p. 169.

Type.— No. 51,970, ♂; western Szechuan, Wa Shan Mountain; 31 May, 1908; W. R. Zappey.

I wholly agree with Rothschild in considering Heteroxenicus a synonym of Brachypteryx.

Heteroxenicus cruralis laurentei La Touche

now Brachypteryx cruralis laurentei (La Touche)

Heteroxenicus cruralis laurentei La Touche, Bull. B. O. C., **42**, 1921, p. 29.

Type.— No. 127,029 ♂; Yunnan, Mengtsz; 31 October, 1920; La Touche Collection.

Heteroxenicus joannae La Touche

now Brachypteryx joannae (La Touche)

Heteroxenicus joannae La Touche, Bull. B. O. C., **43**, 1922, p. 21.

Type.— No. 127,020, ♀; Yunnan, Mengtsz; 3 May, 1921; La Touche Collection.

Brachypteryx carolinae La Touche

now Brachypteryx leucophrys carolinae La Touche

Brachypteryx carolinae La Touche, Bull. B. O. C., **8**, 1898, p. 9.

Cotype.— No. 127,026, ♀; northwest Fohkien, Kuatun; 11 May, 1898; La Touche Collection.

Cotype.— No. 127,027, ♂; northwest Fohkien, Kuátun; 11 April, 1898; La Touche Collection.

† Tesia cyaniventer superciliaris La Touche

= Tesia cyaniventer Hodgson

Tesia cyaniventer superciliaris La Touche, Bull. B. O. C., **42**, 1921, p. 8.

Type.— No. 127,031, ♂; Yunnan, Mengtsz; 16 March, 1921; La Touche Collection.

Tesia cyaniventer Hodgson, Jour. A. S. Bengal, **6**, 1837, p. 101. Kinnear (Ibis, 1929, p. 303) relegates La Touche's name to synonymy.

† Tesia grallator Thayer and Bangs

= Oligura castaneocoronata dejeani (Oustalet)

Tesia grallator Thayer and Bangs, Mem. Mus. Comp. Zoöl., **40**, no. 4, 1912, p. 168.

Type.— No. 51,975, ♀; western Szechuan, Wa Shan Mountain; 31 May, 1908; W. R. Zappey.

Cryptolopha Dejeani Oustalet, Bull. Mus. Paris, 1896, p. 316.

Actinodura ramsayi yunnanensis Bangs and Phillips

Actinodura ramsayi yunnanensis Bangs and Phillips, Bull. Mus. Comp. Zoöl., **58**, 1914, p. 288.

Type.— No. 62,025 ♂; Yunnan, Loukouchai; 29 January, 1911; Kobayashi Collection.

Minla ignotincta mariae La Touche

Minla ignotincta mariae La Touche, Bull. B. O. C., **42**, 1921, p. 30.

Cotype.— No. 127,116, ♂; Yunnan, Milati; 13 January, 1921; La Touche Collection.

Cotype.— No. 127,117, ♀; Yunnan, Loukouchai; 4 March, 1921; La Touche Collection.

Mesia argentauris ricketti La Touche

Mesia argentauris ricketti La Touche, Bull. B. O. C., **43**, 1923, p. 173.

Type.— No. 127,140, ♂; Yunnan, Szemao; 23 January, 1923; E. P. Laurente.

Suthora davidiana Slater

now Neosuthora davidiana davidiana (Slater)

Suthora davidiana Slater, Ibis, 1897, p. 172, pl. 4, fig. 1.

Cotype.— No. 127,169; northwest Fohkien, Kuatun; [May–June], 1896; La Touche Collection.

This specimen has, written in Slater's hand on its label "*Suthora davidiana* n. sp." and in La Touche's hand "cotype."

Suthora unicolor canaster Thayer and Bangs

Suthora unicolor canaster Thayer and Bangs, Mem. Mus. Comp. Zoöl., **40**, no. 4, 1912, p. 171.

Type.— No. 50,709, ♂; western Szechuan, Wa Shan mountain; 3 November, 1908; W. R. Zappey.

SUTHORA GULARIS PALLIDA La Touche

Suthora gularis pallida La Touche, Bull. B. O. C., **43**, 1922, p. 20.

Type.— No. 127,182; northwest Fohkien, Kuatun; late winter, 1911; La Touche Collection.

SUTHORA CONSPICILLATA ROCKI Bangs and Peters

Suthora conspicillata rocki Bangs and Peters, Bull. Mus. Comp. Zoöl., **68**, 1928, p. 345.

Type.— No. 50,711, ♂; Hupeh, Hsientientsze; 2 June, 1907; W. R. Zappey.

SUTHORA ZAPPEYI Thayer and Bangs

Suthora zappeyi Thayer and Bangs, Mem. Mus. Comp. Zoöl., **40**, no. 4, 1912, p. 171.

Type.— No. 50,738, ♂; western Szechuan, Wa Shan mountain; 3 November, 1908; W. R. Zappey.

SUTHORA WEBBIANA YUNNANENSIS La Touche

now SUTHORA ALPHONSIANA YUNNANENSIS La Touche

Suthora webbiana yunnanensis La Touche, Bull. B. O. C., **42**, 1921, p. 31.

Cotype.— No. 127,189, ♂; Yunnan, Kopaotsum; 13 May, 1921; La Touche Collection.

Cotype.— No. 127,190, ♀; Yunnan, Kopaotsum; 15 May, 1921; La Touche Collection.

SUTHORA WEBBIANA ELISABETHAE La Touche

Suthora webbiana elizabethae La Touche, Bull. B. O. C., **41**, 1921, p. 52.

Type.— No. 127,200, ♂; Yunnan, Loukouchai (died in confinement, 12 November, 1921); La Touche Collection.

The three skins from Loukouchai recorded by Phillips and me as *Suthora webbiana webbiana* Gray (Bull. Mus. Comp. Zoöl., **58**, 1914, p. 290), prove to belong to this form.

SUTHORA WEBBIANA FOHKIENENSIS La Touche

Suthora webbiana fohkienensis La Touche, Bull. B. O. C., **43**, 1923, p. 101.

Cotype.— No. 127,227, ♂; northwest Fohkien, Kuatun; 20 April, 1898; La Touche Collection.

Cotype.— No. 127,228, ♀; northwest Fohkien, Kuatun; May, 1907; La Touche Collection.

Suthora webbiana rosea La Touche

Suthora webbiana rosea La Touche, Bull. B. O. C., **43**, 1923, p. 101.

Cotype.— No. 127,220, ♂; northeast Chihli, Shanhaikuan; January, 1913; La Touche Collection.

Cotype.— No. 127,221, ♀; northeast Chihli, Shanhaikuan; January, 1913; La Touche Collection.

Suthora webbiana pekinensis La Touche

Suthora webbiana pekinensis La Touche, Bull. B. O. C., **43**, 1923, p. 101.

Type.— No. 127,197, ♂; Peking; La Touche Collection.

Hartert does not agree with La Touche in recognizing so many forms of *Suthora webbiana* (cf. Die Vögel. der Palae. Fauna, Nachtrag 1, 1923, p. 45) and reduces *rosea* and *pekinensis* to the synonymy of *fulvicauda* Campbell, and *fohkienensis* to the synonymy of *suffusa* Swinhoe. I have gone over the material very carefully and I must say that I can see slight differences as La Touche arranges the forms, and the same old question arises as to how far we want to go in dividing a variable species into subspecies.

TROGLODYTIDAE

Limnornis unirufus Lafresnaye

now Cinnicerthia unirufa (Lafresnaye)

Limnornis unirufus Lafresnaye, Rev. Zoöl., 1840, p. 105.

Cotype.— No. 76,157; Lafresnaye Collection, no. 2,626; "Sta. Fé de Botogá"

Cotype.— No. 76,158; Lafresnaye Collection, no. 2,625; "Sta. Fé de Bogotá."

Cotype.— No. 76,159; Lafresnaye Collection, no. 2,624; "Sta. Fé de Bogotá."

Lafresnaye wrote exactly similar labels for all three of his specimens.

† Limnornis canifrons Lafresnaye

= Cinnicerthia unirufa (Lafresnaye)

Limnornis canifrons Lafresnaye, Rev. Zoöl., 1840, p. 105.

Type.— No. 76,161; Lafresnaye Collection, no. 2,622; "Bogotá."

Limnornis unirufus Lafresnaye, Rev. Zoöl., 1840, p. 105.

L. canifrons is, of course, the immature plumage of *L. unirufus*.

Limnornis unibrunneus Lafresnaye

now Cinnicerthia unibrunnea (Lafresnaye)

Limnornis ou *Thryothorus unibrunneus* Lafresnaye, Rev. et Mag. Zoöl., 1853, p. 59.

Cotype.— No. 76,162; Lafresnaye Collection, no. 2,628; "Rep. de l'équateur" (=Ecuador).

Cotype.— No. 76,163; Lafresnaye Collection, no. 2,627; "Rep. de l'équateur"(=Ecuador).

Lafresnaye (*l. c.*, p. 60) mentions three specimens. There were, however, but two as above, in the Lafresnaye Collection at the time Verreaux catalogued it.

Buglodytes albicilius Bonaparte

now Heleodytes minor albicilius (Bonaparte)

Buglodytes albicilius Bonaparte, Comp. Rend., **38**, 1854, p. 57.

Type.— No. 76,139; Lafresnaye Collection, no. 2,597; Santa Marta.

For this specimen Lafresnaye wrote the following label — "*Buglodytes albicilius* Bp. consp. av. 2'edit. type de Bp. Nlle. Grenade Sta. Marthe."

Campylorhynchus unicolor Lafresnaye

now Heleodytes unicolor (Lafresnaye)

Campylorhynchus unicolor Lafresnaye, Rev. Zoöl., 1846, p. 93.

Type.— No. 76,155; Lafresnaye Collection, no. 2,598; Guarayos, Bolivia; d'Orbigny.

The type of *unicolor* is an adult bird in much worn plumage. Lafresnaye tells us (l. c., p. 93) that it was brought back by d'Orbigny and that in the Synopsis Avium, he erroneously judged it to be some phase of plumage of *C. scolopaceus* Spix [=*H. turdinus* (Wied)].

† Campylorhynchus unicoloroides Lafresnaye

= Heleodytes unicolor (Lafresnaye)

Campylorhynchus unicoloroides Lafresnaye, Rev. Zoöl., 1846, p. 316.

Type.— No. 76,156; Lafresnaye Collection, no. 2,599; "Bolivie."

Campylorhynchus unicolor Lafresnaye, Rev. Zoöl., 1846, p. 93.

The type of *unicoloroides* was obtained by Lafresnaye from Parzudaki. It is a youngish bird with a brownish head, and shows some slight spotting below and indication of barring above.

Campylorhynchus rufinucha Lafresnaye
now Heleodytes rufinucha (Lafresnaye)

Campylorhynchus rufinucha Lafresnaye, Rev. Zoöl., 1845, p. 339.

Type.— No. 76,323; Lafresnaye Collection, no. 2,616; "Mexique."

There are two additional specimens of this species in the Lafresnaye Collection, nos. 2,618 and 2,617, the former an immature bird and the latter showing some slight differences from the type. With the three specimens before me, it is perfectly clear that Lafresnaye drew his description wholly from No. 2,616.

Heleodytes narinosus Phillips

Heleodytes narinosus Phillips, Auk, **28**, 1911, p. 81.

Type.— No. 49,964, ♀; Mexico, Tamaulipas, Galindo; 22 March, 1909; F. B. Armstrong.

This form is probably a subspecies of *H. gularis* (Sclater) of west central Mexico.

Heleodytes zonatus impudens Bangs and Peters

Heleodytes zonatus impudens Bangs and Peters, Bull. Mus. Comp. Zoöl., **68**, 1928, p. 398.

Type.— No. 238,315, ♂; Oaxaca, Chivela; 2 March, 1927; W. W. Brown.

Campylorhynchus brevirostris Lafresnaye
now Heleodytes zonatus brevirostris (Lafresnaye)

Campylorhynchus brevirostris Lafresnaye, Rev. Zoöl., 1845, p. 339.

Cotype.— No. 76,145; Lafresnaye Collection, no. 2,610; "Bogotá."

Cotype.— No. 76,146; Lafresnaye Collection, no. 2,609; "Bogotá."

The two cotypes of this form, for which Lafresnaye wrote labels exactly alike, are young birds in juvenile plumage.

† Campylorhynchus zonatoides Lafresnaye
= Heleodytes zonatus brevirostris (Lafresnaye)

Campylorhynchus zonatoides Lafresnaye, Rev. Zoöl., 1846, p. 92.

Cotype.— No. 76,147; Lafresnaye Collection, no. 2,607; "Mexique ou Colombie."

Cotype.— No. 76,148; Lafresnaye Collection, no. 2,606; "Mexique ou Colombie."

Cotype.— No. 76,149; Lafresnaye Collection, no. 2,608; "Mexique ou Colombie."

The three specimens upon which Lafresnaye founded his *zonatoides* are all adult, one in very abraded plumage.

Campylorhynchus curvirostris Ridgway

now Heleodytes curvirostris (Ridgway)

Campylorhynchus curvirostris Ridgway, Proc. Bost. Soc. N. H., **23**, 1887, p. 385.

Type.— No. 76,135; Lafresnaye Collection, no. 2,621; "Nouvelle Grenade."

For thirty years this species remained a mystery, until proved to be the common species of the Santa Marta region. (cf. Todd, Annals Carnegie Mus., **14**, 1922, p. 423).

Picolaptes brunneicapillus Lafresnaye

now Heleodytes brunneicapillus brunneicapillus (Lafresnaye)

Picolaptes brunneicapillus Lafresnaye, Mag. Zoöl., 1835, pl. 47.

Type.— No. 76,143; Lafresnaye Collection, no. 2,600; "California" (error = coast region of southern Sonora).

I have compared the type with specimens of *all* the subspecies of *H. brunneicapillus* and wholly agree with Ridgway that it represents the form peculiar to the coast district of southern Sonora.

The specimen was given to Lafresnaye by Charles Brelay. It was obtained from an officer whose ship was said by Lafresnaye to have been in California and in Peru. Therefore, not improbably a stop was also made at Guaymas, Sonora, an important port, and a place where the bird in question is a common species.

In all the Lafresnaye Collection this is the only specimen I find that must have come from this region — the coast district of southern Sonora.

Campylorhynchus megalopterus Lafresnaye

now Heleodytes megalopterus (Lafresnaye)

Campylorhynchus megalopterus Lafresnaye, Rev. Zoöl., 1845, p. 339.

Type.— No. 76,151; Lafresnaye Collection, no. 2,612; "Mexique."

Another example, no. 2,611 Lafresnaye Collection, is not a cotype,

as Lafresnaye thought it might represent something else, and wrote a label for it to that effect.

Campylorhynchus pallescens Lafresnaye

now Heleodytes fasciatus pallescens (Lafresnaye)

Campylorhynchus pallescens Lafresnaye, Rev. Zoöl., 1846, p. 93.

Type.— No. 76,137; Lafresnaye Collection, no. 2,613; "Mexique" (error = southwest Ecuador).

† Campylorhynchus pardus Bonaparte

= Heleodytes nuchalis (Cabanis)

Campylorhynchus pardus Bonaparte ex. Verreaux MS., Comp. Rend. Acad. des Sci. Paris, **38**, 1854, p. 61.

Type.— No. 76,138; Lafresnaye Collection, no. 2,619; "Nouvelle — Grenade."

Campylorhynchus nuchalis Cabanis, Arch. fur Naturg., **1**, 1847, p. 206.

Lafresnaye wrote the following label for his specimen:— "*Campylorhynchus pardus* Verr. Mss. Bp. Comp. Rend. acad. des science 1853 type de Verr. Nouvelle Grenade."

In discussing the genus Campylorhynchus, Bonaparte (*l.c.*, p. 61) makes the statement — "MM. Verreaux ont reçu de la Nouvelle Grenade, une belle éspèce elegamment tachetée qu'ils feront connaître sous le nom *Camp. pardus*."

This brief diagnosis, inadequate though it be, when supplemented by the type specimen is, nevertheless, enough to conserve the name. It is not a *nomen nudum*. The subsequent use of the name is precluded, for any but the same species. Sclater's *Campylorhynchus pardus* (P. Z. S., 1857, p. 271) is also based upon a Verreaux manuscript name for the same species but is, of course, antedated by Bonaparte's *C. pardus*. Sclater's type is now in the American Museum of Natural History.

C. pardus of Sclater which is the same form as *C. pardus* of Bonaparte has at times been recognized as a valid subspecies, but Chapman (Bull. Am. Mus., 1917, **36**, p. 511) says he cannot in any way distinguish the Santa Marta and lower Magdalena Valley specimens (= *pardus*) from Venezuelan skins (= true *nuchalis*). I, therefore, follow him in throwing the name *pardus* into synonymy. More recently Todd, in his Birds of Santa Marta Region, Colombia, also expresses the same opinion.

Troglodytes albinucha Cabot

now Thryomanes albinucha (Cabot)

Troglodytes albinucha Cabot, Proc. Bost. Soc. N. H., **2**, 1847, p. 258.

Type.— No. 72,514; Yucatan, near Yalahao; 6 April, 1842; S Cabot.

Ferminia cerverai Barbour

Ferminia cerverai Barbour, Proc. New Eng. Zoöl. Club, **9**, 1926, p. 73.

Type.— No. 235,226, ♂; Cuba, Peninsula de Zapata, Santo Tomas; 7 September, 1926; F. Z. Cervera.

Thriothorus leucotis Lafresnaye

now Thryophilus leucotis (Lafresnaye)

Thriothorus leucotis Lafresnaye, Rev. Zoöl., 1845, p. 338.

Type.— No. 76,369; Lafresnaye Collection, no. 2,656; "Colombie ou Mexique" (Bogotá, fixed by Brabourne and Chubb).

Verreaux in his catalogue of the Lafresnaye Collection listed this specimen as *Thryothorus albipectus* Cabanis.

Thryophilus galbraithi conditus Bangs

Thryophilus galbraithi conditus Bangs, Proc. New Eng. Zoöl. Club, **4**, 1903, p. 3.

Type.— No. 104,944, ♂; San Miguel Island, Pearl Islands, Bay of Panama; 4 May, 1900; W. W. Brown.

Thryophilus modestus elutus Bangs

Thryophilus modestus elutus Bangs, Proc. New Eng. Zoöl. Club, **3**, 1902, p. 51.

Type.— No. 107,354, ♀; Panama, Loma del Leon; 26 March, 1900; W. W. Brown.

Thriothorus rufalbus Lafresnaye

now Thryophilus rufalbus rufalbus (Lafresnaye)

Thriothorus rufalbus Lafresnaye, Rev. Zoöl., 1845, p. 337.

Type.— No. 76,166; Lafresnaye Collection, no. 2,647; "Mexico."

Verreaux listed three specimens as "types" of this form; No. 2,648 is not a cotype and 2,649 proves to be *Thryophilus rufalbus castanonotus* Ridgway.

Thryophilus sinaloa cinereus Brewster

Thryophilus sinaloa cinereus Brewster, Auk, **6**, 1889 (April), p. 96. Separates issued in advance, January 31, 1889.

Cotype.— No. 214,385, ♂; Sonora, Alamos; 28 March, 1888; M. A. Frazar.

Cotype.— No. 214,386, ♀; Sonora, Alamos; 6 March, 1888; M. A. Frazar.

Pheugopedius spadix Bangs

now Pheugopedius spadix spadix Bangs

Pheugopedius spadix Bangs, Proc. Biol. Soc. Washington, **23**, 1910, p. 74.

Type.— No. 123,446, ♂; western Colombia, Naranjito, Rio Dagua; 20 June, 1908; M. G. Palmer.

Pheugopedius spadix xerampelinus Griscom

Pheugopedius spadix xerampelinus Griscom, Bull. Mus. Comp. Zoöl., **69**, 1929, p. 182.

Type.— No. 140,510, ♂; Eastern Panama, Cana; 13 April, 1928; Rex. R. Benson.

Thriothorus fasciatoventris Lafresnaye

now Pheugopedius fasciatoventris fasciatoventris (Lafresnaye)

Thriothorus fasciatoventris Lafresnaye Rev. Zoöl. 1845, p. 337,

Type.— No. 76,170; Lafresnaye Collection, no. 2,658; "Bogotá."

Pheugopedius mystacalis saltuensis Bangs

Pheugopedius mystacalis saltuensis Bangs, Proc. Biol. Soc. Washington, **23**, 1910, p. 74.

Type.— No. 123,448, ♂; western Colombia, San Luis, Bitaco Valley; 5 June, 1908; M. G. Palmer.

In his Distribution of Bird-Life in Colombia, 1917, Chapman was disinclined to recognize this form; later, however, in Distribution of Bird-Life in Ecuador, 1926, he says he now considers it a valid race.

THRIOTHORUS MACULIPECTUS Lafresnaye

now PHEUGOPEDIUS MACULIPECTUS MACULIPECTUS (Lafresnaye)

Thriothorus maculipectus Lafresnaye, Rev. Zoöl., 1845, p. 338.

Type.— No. 76,169; Lafresnaye Collection, no. 2,657; "Mexique" (probably from Vera Cruz).

THRYOTHORUS LAETUS Bangs

now PHEUGOPEDIUS LAETUS (Bangs)

Thryothorus laetus Bangs, Proc. Biol. Soc. Washington, **12**, 1898, p. 160.

Type.— No. 105,601, ♂; Colombia, Santa Marta Mountains, Pueblo Viejo; 19 March, 1898; W. W. Brown.

† THRYOTHORUS RUFICEPS Ridgway

= PHEUGOPEDIUS FELIX FELIX (Sclater)

Thryothorus ruficeps Ridgway (ex Lafr. MS.), Proc. Bost. Soc. N. H., **23**, 1887, p. 387 "Brazil" (error = Mexico).

Type.— No. 76,136; Lafresnaye Collection, no. 2,659; "Brazil"

Thryothorus felix Sclater, P. Z. S., 1859, p. 371.

TROGLODYTES PARKMANII Audubon

now TROGLODYTES AËDON PARKMANII Audubon

Troglodytes parkmanii Audubon, Orn. Biog., **5**, 1839, p. 310.

Type.— No. 140,279; Columbia River; J. K. Townsend.

Audubon states that Townsend secured but a single specimen. This was mounted in a funny little pasteboard box with glass front and back and presented to Dr. Parkman by Audubon, for whom he had named it.

The type specimen, together with the letters from Audubon to Parkman concerning it, and some fine Audubon paintings, all formerly the property of Dr. George Parkman of Boston, were secured some years ago by Colonel John E. Thayer, who presented the type to the Museum. (Cf. Thayer, Auk, **33**, no. 2, 1916, pp. 115–118).

Ridgway, Birds of North and Middle America, claims the type of *Troglodytes parkmanii* as being in the United States National Museum. This is incorrect and the U. S. N. M. specimen is not a type at all.

Thriothorus striatulus Lafresnaye

now Troglodytes musculus striatulus (Lafresnaye)

Thriothorus striatulus Lafresnaye, Rev. Zoöl., 1845, p. 338.

Type.— No. 76,191; Lafresnaye Collection, no. 2,678; "Bogotá." Verreaux entered this specimen in his catalogue as *Troglodytes furva* Gmelin.

Chapman (Bull. Am. Mus., N. H., 1917, p. 518) on the assumption that the type of Lafresnaye's *Thriothorus striatulus* was lost, restricted that name to the bird inhabiting "the tropical and subtropical zones of the Magdalena Valley slope of the eastern Andes."

The type specimen is now a good deal faded, but as nearly as can possibly be judged by it, in its present condition, Chapman's conclusions were correct.

† Troglodytes musculus paramaribensis Bangs and Penard

= Troglodytes musculus albicans Berlepsch and Taczanowski

Troglodytes musculus paramaribensis Bangs and Penard, Bull. Mus. Comp. Zoöl., **62**, 1918, p. 81.

Type.— No. 80,923, ♂; Surinam, vicinity of Paramaribo; 20 May, 1912.

Troglodytes furvus albicans Berlepsch and Taczanowski, P. Z. S., 1883, p. 540.

† Troglodytes irrequies Bangs and Peck

= Troglodytes musculus intermedius Cabanis

Troglodytes irrequies Bangs and Peck, Proc. Biol. Soc. Washington, **21**, 1908, p. 45.

Type.— No. 119,802, ♂; British Honduras, Sittee River; 22 April, 1907; M. E. Peck.

Troglodytes intermedius Cabanis, J. f. O., 1860, p. 407.

Troglodytes cahooni Brewster

now Troglodytes brunneicollis cahooni Brewster

Troglodytes cahooni Brewster, Auk, **5**, 1888, p. 94.

Cotype.— No. 214,132, ♂; Sonora, near Oposura; 31 May, 1887; J. C. Cahoon.

Cotype.— No. 214,133, ♀; Sonora, near Oposura; 31 May, 1887; J. C. Cahoon.

TROGLODYTES MONTICOLA Bangs

Troglodytes monticola Bangs, Proc. Biol. Soc. Washington, **13**, 1899, p. 106.

Type.— No. 106,066, ♀; Colombia, Santa Marta Mountains, Paramo de Chiruqua; 25 March, 1899; W. W. Brown.

TROGLODYTES OCHRACEUS LIGEA Bangs

Troglodytes ochraceus ligea Bangs, Proc. New Eng. Zoöl. Club, **4**, 1908, p. 29.

Type.— No. 108,627, ♂; Panama, Boquete; 2 March, 1901; W. W. Brown.

TROGLODYTES BROWNI Bangs

now THRYORCHILUS BROWNI BROWNI (Bangs)

Troglodytes browni Bangs, Proc. New Eng. Zoöl. Club, **3**, 1902, p. 53.

Type.— No. 108,631, ♂; Panama, Volcan de Chiriqui; 21 May, 1901; W. W. Brown.

THRYORCHILUS RIDGWAYI Bangs

now THRYORCHILUS BROWNI RIDGWAYI Bangs

Thryorchilus ridgwayi Bangs, Proc. Biol. Soc. Washington, **19**, 1906, p. 108.

Type.— No. 117,152; Costa Rica, Volcan de Irazu; 4 March, 1899; C. F. Underwood.

NANNUS HIEMALIS SEMIDIENSIS W. S. Brooks

now NANNUS TROGLODYTES SEMIDIENSIS W. S. Brooks

Nannus hiemalis semidiensis W. S. Brooks, Bull. Mus. Comp. Zoöl., **59**, 1915, p. 400.

Type.— No. 66,711, ♂; Alaska, Choyiet Island, Semidi Islands; 18 April, 1913; W. S. Brooks.

ELACHURA LAURENTII La Touche

Elachura laurentii La Touche, Bull. B. O. C., **43**, 1923, p. 171.

Type.— No. 127,317; Yunnan, Mahnangpo, Hokow; 13 July, 1921; E. P. Laurente.

HENICORHINA PROSTHELEUCA TROPAEA Bangs and Peters

Henicorhina prostheleuca tropaea Bangs and Peters, Bull. Mus. Comp. Zoöl., **67**, 1927, p. 480.

Type.— No. 121,443, ♂; Costa Rica, La Vijagua; 25 February, 1908; C. F. Underwood.

Henicorhina leucosticta eucharis Bangs

now Henicorhina prostheleuca eucharis Bangs

Henicorhina leucosticta eucharis Bangs, Proc. Biol. Soc. Washington, **23**, 1910, p. 74.

Type.— No. 123,444, ♂; western Colombia, Pavas; 18 February, 1908; M. G. Palmer.

Henicorhina anachoreta Bangs

now Henicorhina (leucophrys?) anachoreta Bangs

Henicorhina anachoreta Bangs, Proc. New Eng. Zoöl. Club, **1**, 1899, p. 84.

Type.— No. 106,494, ♀; Colombia, Santa Marta Mountains, Paramo de Chiruqua; 8 March, 1899; W. W. Brown.

Henicorhina collina Bangs

now Henicorhina leucophrys collina Bangs

Henicorhina collina Bangs, Proc. New Eng. Zoöl. Club, **3**, 1902, p. 55.

Type.— No. 108,640, ♂; Panama, Boquete; 16 April, 1901; W. W. Brown.

Cistothorus polyglottus lucidus Ridgway

Cistothorus polyglottus lucidus Ridgway, Proc. Biol. Soc. Washington, **16**, 1903, p. 169.

Type.— No. 108,624, ♂; Panama, Boquete; 25 April, 1901; W. W. Brown.

Cistothorus palustris dissaeptus Bangs

now Telmatodytes palustris dissaeptus (Bangs)

Cistothorus (Telmatodytes) palustris dissaeptus Bangs, Auk, **19**, 1902, p. 352.

Type.— No. 109,796, ♂; Massachusetts, Wayland; 31 May, 1879; E. A. and O. Bangs.

My "split" in separating the marsh wren of the fresh-water marshes of Massachusetts and northern New England from true *palustris* of the middle Atlantic states has not yet met with general approval. I

am, however, not inclined to give it up. It is larger than true *palustris* and browner, less purely white below, and slightly paler above.

Telmatodytes palustris laingi Harper

Telmatodytes palustris laingi Harper, Occ. Papers, Bost. Soc. N. H., **5**, 1926, p. 221.

Type.— No. 231,790, ♂; Alberta, Athabaska Delta, Main Branch; 3 June, 1920; F. Harper.

Cistothorus palustris griseus Brewster

now Telmatodytes palustris griseus (Brewster)

Cistothorus palustris griseus Brewster, Auk, **10**, 1893, p. 216.

Type.— No. 219,008, ♂; Georgia, Sapelo Island; 17 November, 1887; W. W. Worthington.

Microcerculus corrasus Bangs

now Microcerculus squamulatus corrasus Bangs

Microcerculus corrasus Bangs, Proc. New Eng. Zoöl. Club, **3**, 1902, p. 87.

Type.— No. 106,070, ♀; Colombia, Santa Marta Mountains, Chirua; 13 March, 1899; W. W. Brown.

† Microcerculus acentetus Bangs

= Microcerculus philomela (Salvin)

Microcerculus acentetus Bangs, Proc. New Eng. Zoöl. Club, **3**, 1902, p. 56.

Type.— No. 108,651, ♂; Panama, Boquete; 18 April, 1901; W. W. Brown.

Cyphorhinus philomela Salvin, P. Z. S., 1861, p. 202.

I can see no way to distinguish more than one form of Microcerculus in Central America and, therefore, throw *luscinia* Salvin, *daulias* Ridgway and, of course, *acentetus* Bangs into the synonymy of *philomela*.

Pnoepyga mutica Thayer and Bangs

now Pnoepyga squamata mutica Thayer and Bangs

Pnoepyga mutica Thayer and Bangs, Mem. Mus. Comp. Zoöl., **40**, no. 4, 1912, p. 172.

Type.— No. 51,974, ♂; western Szechuan, Wa Shan Mountain; 3 June, 1908; W. R. Zappey.

CINCLIDAE

Cinclus pallasii wilderi La Touche

Cinclus pallasii wilderi La Touche, Handbook of Birds of Eastern China, pt. 2, 1925, p. 98.

Type.— No. 127,294, ♂; Chihli, Eastern Tombs; 27 January, 1925; G. D. Wilder.

Cinclus rivularis Bangs

Cinclus rivularis Bangs, Proc. Biol. Soc. Washington, **13**, 1899, p. 105.

Type.— No. 106,049, ♂; Colombia, Santa Marta Mountains, Chirua, 7 February, 1899; W. W. Brown.

MIMIDAE

Mimus polyglottos delenificus Bangs

Mimus polyglottos delenificus Bangs, Proc. New Eng. Zoöl. Club, **6**, 1916, p. 23.

Type.— No. 68,495, ♂; Bahamas, Andros Island, Mastic Point; 24 April, 1915; C. J. Maynard.

Mimus polyglottos bahamensis Bryant

now Mimus polyglottos elegans Sharpe

Mimus polyglottus (var. *Bahamensis* "?") Bryant, Proc. Bost. Soc. N. H., **11**, 1867, p. 68. (Not *Mimus bahamensis* Bryant, Proc. Bost. Soc. N. H., **7**, 1859, p. 114.)

Mimus elegans Sharpe, Cat. Birds, Brit. Mus., **6**, 1881, p. 339 (new name to replace *Mimus polyglottus* var. *bahamensis* Bryant, preoccupied.)

Cotype.— No. 72,287, Inagua; H. Bryant.

There is another cotype in the British Museum, possibly also others exist in other museums.

Orpheus dorsalis d'Orbigny and Lafresnaye

now Mimus dorsalis (d'Orbigny and Lafresnaye)

Orpheus dorsalis d'Orbigny and Lafresnaye, Mag. de Zoöl., 1837, p. 18.

Cotype.— No. 76,530; Lafresnaye Collection, no. 3,640; "in andii-repa. Bola. Lapaz, d'Orb."

Hellmayr has seen this specimen and considers it a cotype. In the Paris Museum there are three more examples of d'Orbigny's collecting.

Mimus bahamensis Bryant

now Mimus gundlachii bahamensis Bryant

Mimus bahamensis Bryant, Proc. Bost. Soc. N. H., **7**, 1859, p. 114.

Cotype.— No. 46,870, ♂; Bahamas, Berry Island; 20 April; H. Bryant.
Cotype.— No. 46,871, ♀; Bahamas, Berry Island; 14 April; H. Bryant.

I think it doubtful if *M. bahamensis* can be kept distinct from *M. gundlachi*, even as a subspecies. I have, however, seen but few skins of the latter.

Mimus carolinensis grisifrons Maynard

= Dumetella carolinensis (Linné)

Minus (sic) *carolinensis grisifrons* Maynard, Birds E. N. Am., pt. 40, 1896, p. 710.

Type.— No. 13,927, ♂; Florida, Florida Keys; 5 December, 1870; C. J. Maynard.

Muscicapa carolinensis Linné, Syst. Nat., ed. 12, **1**, 1766, p. 328.

† Galeoscoptes bermudianus Bangs and Bradlee

= Dumetella carolinensis (Linné)

Galeoscoptes bermudianus Bangs and Bradlee, Auk, **18**, 1901, p. 253.

Type.— No. 39,130, ♀; Bermudas, Hamilton; 8 March, 1901; T. S. Bradlee.

Muscicapa carolinensis Linné, Syst. Nat., ed. 12, **1**, 1766, p. 328.

The resident cat bird of Bermuda, no longer migratory, has already shown the effect of this in the slight shortening of the wing, particularly of the wing-tip. This difference is, however, perhaps not yet sufficiently great to entitle it to a distinctive name.

Orpheus longirostris Lafresnaye

now Toxostoma longirostris longirostris (Lafresnaye)

Orpheus longirostris Lafresnaye, Rev. Zoöl., 1838, p. 55.

Type.— No. 76,533; Lafresnaye Collection, no. 3,633; "Mexique." Two additional specimens, nos. 3,631 and 3,632, were evidently re-

ceived by Lafresnaye at a later date and are not cotypes. The Baron wrote labels for them very different from that which he wrote for the type.

† Toxostoma rediviva helva Thayer and Bangs

= Toxostoma redivivum redivivum (Gambel)

Toxostoma rediviva helva Thayer and Bangs, Proc. New Eng. Zoöl. Club, **4**, 1907, p. 17.

Type.— No. 6,000, collection of John E. Thayer deposited in the Museum of Comparative Zoölogy, ♀ ; Lower California, Rosario; 19 November, 1906; W. W. Brown.

Harpes rediviva Gambel, Proc. Ac. Nat. Sci. Phila. 2, 1845, p. 264.

Grinnell now considers (A Distributional Summation of the Ornithology of Lower California, 1928, p. 245) that *helva* cannot be distinguished from true *redivivum*.

Melanotis caerulescens effuticius Bangs and Penard

Melanotis caerulescens effuticius Bangs and Penard, Proc. Biol. Soc. Washington, **34**, 1921, p. 91.

Type.— No. 220,386,♂ ; Chihuahua, Hacienda de San Rafael; 4 May 1888; M. A. Frazar.

Donacobius albovittatus d'Orbigny and Lafresnaye

now Donacobius atricapillus albovittatus (d'Orbigny and Lafresnaye)

Donacobius albo-vittatus d'Orbigny and Lafresnaye, Mag. Zoöl., 1837, p. 19.

Cotype.— No. 76,379; Lafresnaye Collection, no. 2,594; "Bolivie, Chiquitos"; d'Orbigny.

Hellmayr has passed upon this specimen, and considers it a cotype.

Ramphocinclus gutturalis Lafresnaye

now Cinclocerthia gutturalis (Lafresnaye)

Ramphocinclus gutturalis Lafresnaye, Rev. Zoöl., 1843, p. 67.

Type.— No. 76,366; Lafresnaye Collection, no. 2,696; "Cuba et Antilles" (= Martinique).

Ramphocinclus tremulus Lafresnaye

now Cinclocerthia ruficauda tremula (Lafresnaye)

Ramphocinclus tremulus Lafresnaye, Rev. Zoöl., 1843, p. 67.

Type.— No. 76,365; Lafresnaye Collection, no. 2,698; "Guadeloupe"; l'Herminier.

Cinclocerthia ruficauda sola Bangs

Cinclocerthia ruficauda sola Bangs, Proc. New Eng. Zoöl. Club, **11**, 1929, p. 39.

Type.— No. 76,364; Lafresnaye Collection, no. 2,697; "Guadeloupe" (an error — probably some small island near Guadeloupe, possibly Desirade); collected by l'Herminier.

† Turdus montanus Lafresnaye

= Allenia fusca (P. L. S. Müller)

Turdus montanus Lafresnaye, Rev. Zoöl., 1844, p. 167. (Not *Turdus montanus* Voigt, 1831.)

Type.— No. 76,370; Lafresnaye Collection, no. 3,621; "Guadeloupe."

Muscicapa fusca P. L. S. Müller, Natur. Syst., Suppl., 1776, p. 170.

TURDIDAE

Myadestes elizabeth retrusus Bangs and Zappey

Myadestes elizabeth retrusus Bangs and Zappey, Am. Nat., **39**, no. 460, 1905, p. 208.

Type.— No. 113,435, ♂; Isle of Pines, near Cuba, Pasadita; 25 May, 1904; W. R. Zappey.

Myadestes obscurus Lafresnaye

now Myadestes obscurus obscurus Lafresnaye

Myadestes (Swains.) *obscurus* Lafresnaye, Rev. Zoöl., 1839, p. 98.

Type.— No. 76,526; Lafresnaye Collection, no. 4,436; "Mexico" undoubtedly Vera Cruz).

In the article cited above Lafresnaye described a number of new birds from the collection of Charles Brelay of Bordeaux. It is evident

that Brelay gave to Lafresnaye one specimen each of three of these species. For these three Lafresnaye wrote similar labels of his usual sort for the new birds which he described. I therefore claim the types or cotypes of *Dendrocolaptes affinis* and *Pyranga sanguinolenta* (the female cotype) as well as that of the present species. The types of the other species described in this article must have remained in the Brelay cabinet. Certain it is that they did not find their way into the Lafresnaye Collection.

There is a name in synonymy that never has been identified with any known bird — *Tyrannula divaricata* Bonaparte, P. Z. S., 1837 (= June, 1838), p. 112, Mexico.— It has been suggested to me that this may apply to the present species. The description, however, is so imperfect, and if meant for *Myadestes obscurus*, carries so many errors, that I decline to consider it to replace Lafresnaye's name.

Turdus l'herminieri Lafresnaye

now Cichlherminia l'herminieri l'herminieri (Lafresnaye)

Turdus L'Herminieri Lafresnaye, Rev. Zoöl., 1844, p. 167.

Cotype.— No. 76,083; Lafresnaye Collection, no. 3,618; "Guadeloupe."

Cotype.— No. 76,084; Lafresnaye Collection, no. 3,617; "Guadeloupe."

Lafresnaye wrote labels exactly alike for his two cotypes. Long afterwards Ridgway made no. 3,618 Lafresnaye Collection, the type of his *Cichlherminia coryi*.

† Cichlherminia coryi Ridgway

= Cichlherminia l'herminieri l'herminieri (Lafresnaye)

Cichlherminia coryi Ridgway, Smith. Misc. Coll., **47**, 1904, p. 112.

Type.— No. 76,083; Lafresnaye Collection, no. 3,618: "Guadeloupe."

Turdus L'Herminieri Lafresnaye, Rev. Zoöl., 1844, p. 167.

Noble (Bull. Mus. Comp. Zoöl., **60**, 1916, p. 393) with a series of twenty-four skins collected by himself in Guadeloupe, shows conclusively that the characters used by Ridgway to distinguish this supposed form are simply those of age variation, *coryi* Ridgway being the old adult plumage of *l'herminieri* Lafresnaye.

Merula atrosericea Lafresnaye

now Turdus serranus atrosericeus (Lafresnaye)

Merula atro-sericea Lafresnaye, Rev. Zoöl., 1848, p. 3.

Cotype.— No. 76,523, ♂; Lafresnaye Collection, no. 3,591; "Caracas."

Cotype.— No. 76,524, ♀; Lafresnaye Collection, no. 3,592; "Caracas."

Merula infuscata Lafresnaye

now Turdus infuscatus (Lafresnaye)

Merula infuscata Lafresnaye, Rev. Zoöl., 1844, p. 41.

Type.— No. 76,521; Lafresnaye Collection, no. 3,593; "Mexique."

Merula nigropileus Lafresnaye

now Turdus merula nigropileus (Lafresnaye)

Merula nigro-pileus Lafresnaye, Rev. Zoöl., 1840, p. 65.

Type.— No. 76,502; Lafresnaye Collection, no. 3,578; "inde, Plat. des Neelgheries."

Merula olivatra Lafresnaye

now Turdus olivater olivater (Lafresnaye)

Merula olivatra Lafresnaye, Rev. Zoöl., 1848, p. 2.

Cotype.— No. 76,474; Lafresnaye Collection, no. 3,604; "Caracas."

Cotype.— No. 76,475; Lafresnaye Collection, no. 3,605; "Caracas."

Merula protomomelaena yunnanensis La Touche

now Turdus dissimilis yunnanensis (La Touche)

Merula protomomelaena yunnanensis La Touche, Bull. B. O. C., **42**, 1921, p. 30.

Cotype.— No. 127,370, ♂; Yunnan, Milati; 19 January, 1921; La Touche Collection.

Cotype.— No. 127,371, ♀; Yunnan, Milati; 14 January, 1921; La Touche Collection.

Turdus rufopalliatus Lafresnaye

Turdus rofo-palliatus (*sic*) Lafresnaye, Rev. Zoöl., 1840, p. 259.

Type.— No. 76,520; Lafresnaye Collection, no. 3,568; "baye de Monterey, Californie" (=error; Acapulco, Mexico, substituted by Bangs and Penard).

Merula incompta Bangs

now Turdus grayi incomptus (Bangs)

Merula incompta Bangs, Proc. Biol. Soc. Washington, **12**, 1898, p. 144.

Type.— No. 105,560, ♀; Colombia, Santa Marta; 22 January, 1898; W. W. Brown.

Merula phaeopyga minuscula Bangs

now Turdus phaeopyga minusculus (Bangs)

Merula phaeopyga minuscula Bangs, Proc. Biol. Soc. Washington, **12**, 1898, p. 181.

Type.— No. 105,605, ♂; Colombia, Santa Marta Mountains, Pueblo Viejo; 23 March, 1898; W. W. Brown.

Todd (Ann. Carnegie Mus., **14**, 1922, p. 399) refuses to recognize this form, on the ground that the alleged color characters failed to hold good in series, and the differences in size alone did not appeal to him. Size seems to me a more important character in birds than the slight differences in shade of color that some ornithologists lay so much stress upon. In the present instance I recognize this thrush, because it is constantly enough smaller than true *phaeopyga* to enable one always to tell it.

Merula leucauchen cnephosa Bangs

now Turdus assimilis cnephosus (Bangs)

Merula leucauchen cnephosa Bangs. Proc. New Eng. Zoöl. Club, **3**, 1902, p. 92.

Type.— No. 108,701, ♂; Panama, Boquete; 25 February, 1901; W. W. Brown.

Turdus assimilis oblitus Miller and Griscom

Turdus assimilis oblitus Miller and Griscom, Am. Mus. Novitates, no. 184, 1925, p. 12.

Type.— No. 121,261, ♂; Costa Rica, Tenorio; 11 February, 1908; C. F. Underwood.

Turdus assimilis parcolor Austin

Turdus assimilis parcolor Austin, Bull. Mus. Comp. Zoöl., **69**, 1929, p. 386.

Type.— No. 140,066, ♂; British Honduras, Cayo District; 26 March, 1928; Oliver L. Austin, Jr.

Turdus nudigenis Lafresnaye

Turdus nudigenis Lafresnaye, Rev. Zoöl., 1848, p. 4.

Type.— No. 76,501; Lafresnaye Collection, no. 3,551; "Caracas." A second specimen, Lafresnaye Collection, no. 3,550, is not a cotype. It has a wholly differently worded label and was very likely acquired by Lafresnaye at a later date.

Planesticus nigrirostris personus Barbour

now Turdus nigrirostris personus (Barbour)

Planesticus nigrirostris personus Barbour, Proc. Biol. Soc. Washington, **24**, 1911, p. 58.

Type.— No. 53,598, ♀; Lesser Antilles, Grenada, Grand Étang; 6 September, 1910; G. M. Allen.

† Merula albiventris fusa Bangs

= Turdus albiventer ephippialis Sclater

Merula albiventris fusa Bangs, Proc. Biol. Soc. Washington, **13**, 1899, p. 107.

Type.— No. 160,080, ♀; Colombia, Santa Marta Mountains, Chirua; 11 February, 1899; W. W. Brown.

Turdus ephippialis Sclater, P. Z. S., 1862, p. 109.

Turdus cardis latens Thayer and Bangs

Turdus cardis latens Thayer and Bangs, Bull. Mus. Comp. Zoöl., **52**, 1909, p. 140.

Type.— No. 50,015, ♂; Hupeh, Ichang; 27 April, 1907; W. R. Zappey.

Turdus olivaceides Lafresnaye

= Turdus abyssinicus Gmelin

Turdus olivaceides Lafresnaye, Rev. et Mag. Zoöl., 1851, p. 58.

Type.— No. 76,353; Lafresnaye Collection, no. 3,613; "Abyssinie." (probably collected by Ferret and Galinier).

Turdus abyssinicus Gmelin, Syst. Nat., 1789, p. 824.

Turdus fuscater d'Orbigny and Lafresnaye

now Turdus fuscater fuscater d'Orbigny and Lafresnaye

Turdus fuscater d'Orbigny and Lafresnaye, Mag. Zoöl., 1837, p. 16.

Cotype.— No. 76,522; Lafresnaye Collection, no. 3,571; "Andes Lapaz Bolivia."

This specimen, like all our d'Orbigny birds, has been submitted to Hellmayr who considers it a cotype.

Merula gigas cacozela Bangs

now Turdus cacozela (Bangs)

Merula gigas cacozela Bangs, Proc. Biol. Soc. Washington, **12**, 1898, p. 181.

Type.— No. 105,685, ♀ ; Colombia, Santa Marta Mountains, Macotama; 21 June, 1898; W. W. Brown.

Turdus chiguanco d'Orbigny and Lafresnaye

now Turdus chiguanco chiguanco d'Orbigny and Lafresnaye

Turdus chiguanco d'Orbigny and Lafresnaye, Mag. Zoöl., 1837, p. 16.

Cotype.— No. 76,473; Lafresnaye Collection, no. 3,572; "Perou andes, Tacna, d'Orb."

Besides our cotype, Hellmayr tells me there are three in Paris.

Turdus migratorius phillipsi Bangs

Turdus migratorius phillipsi Bangs, Proc. Biol. Soc. Washington, **28**, 1915, p. 125.

Type.— No. 102,130, ♀ ; Vera Cruz, Las Vegas; 20 April, 1897; C. B. Isham.

Oreocincla dauma socia Thayer and Bangs

now Turdus dauma socius (Thayer and Bangs)

Oreocincla dauma socia Thayer and Bangs, Mem. Mus. Comp. Zoöl., **40**, 1912, p. 174.

Type.— No. 51,177, ♂; western Szechuan, Tatsienlu; 28 September, 1908; W. R. Zappey.

Turdus citrinus courtoisi Hartert

Turdus citrinus courtoisi Hartert, Bull. B. O. C., **40**, 1919, p. 52.

Type.— No. 127,398; Anhwei, Leonfang; July, 1917; Père Courtois; La Touche Collection.

† Hylocichla fuscescens fuliginosa Howe

= Hylocichla fuscescens salicicola (Ridgway)

Hylocichla fuscescens fuliginosa Howe, Auk, **17**, 1900, p. 271.

Type.— No. 246,260, ♂; Newfoundland, Codroy; 31 May, 1895; E. Doane.

Hylocichla fuscescens salicicola Ridgway, Proc. U. S. Nat. Mus., **4**, 1882, p. 374.

The Newfoundland Veery is certainly not the same as the more southern true *fuscescens*, but I cannot see any way in which to distinguish it from *salicicola*, and I suspect the latter will prove to have a continuous range across the continent to Newfoundland. (See also Noble, Notes on the Avifauna of Newfoundland, Bull. Mus. Comp. Zoöl., **62**, 1919, p. 565).

Turdus minimus Lafresnaye

now Hylocichla minima minima (Lafresnaye)

Turdus minimus Lafresnaye, Rev. Zoöl., 1848, p. 5.

Type.— No. 76,498; Lafresnaye Collection, no. 3,541; "Bogotá."

Penard and I (Bull. Mus. Comp. Zoöl., **63**, 1919, p. 30) have shown that Lafresnaye's name antedates by many years *Hylocichla aliciae bicknelli* Ridgway, and must be used for that bird.

Turdus nanus Audubon

now Hylocichla guttata nana (Audubon)

Turdus nanus Audubon, Orn. Biol., **5**, 1839, p. 201.

Type.— No. 16,298; Columbia River; J. K. Townsend.

For the history of this specimen, which still carries an original Audubon label cf. Brewster, Bull. Mus. Comp. Zoöl., **41**, 1903, p. 213.

Hylocichla guttata faxoni Bangs and Penard

Hylocichla guttata faxoni Bangs and Penard, Auk, **38**, 1921, p. 433.

Type.— No. 209,370, ♂; New Hampshire, Shelburne; 19 July, 1884; W. Brewster.

Myioturdus fuscater Lafresnaye

now Catharus fuscater fuscater (Lafresnaye)

Myioturdus fuscater Lafresnaye, Rev. Zoöl., 1845, p. 341.

Type.— No. 76,525; Lafresnaye Collection, no. 3,544; "Bogotá."

Catharus gracilirostris accentor Bangs

Catharus gracilirostris accentor Bangs, Proc. New Eng. Zoöl. Club, **3**, 1902, p. 50.

Type.— No. 108,576; Panama, Volcan de Chiriqui; 27 May, 1901; W. W. Brown.

Sialia sialis grata Bangs

Sialia sialis grata Bangs, Auk, **15**, 1898, p. 182.

Type.— No. 14,258, ♂; Florida, Miami; 9 March, 1871; Maynard and Henshaw.

Sialis sialis fulva Brewster

Sialia sialis fulva Brewster, Auk, **2**, 1885, p. 85.

Cotype.— No. 210,225, ♂; Arizona, Santa Rita Mountains; 18 June, 1884; F. Stephens.

Cotype.— No. 210,226, ♀; Arizona, Santa Rita Mountains; 20 June, 1884; F. Stephens.

Grandala coelicolor florentes Bangs

Grandala coelicolor florentes Bangs, Proc. New Eng. Zoöl. Club, **9**, 1926, p. 77.

Type.— No. 96,487, ♂; western Szechuan, Tatsienlu; 6 June, 1915; Hugo Weigold.

Petrophila solitaria magna La Touche

now Monticola solitaria magna (La Touche)

Petrophila solitaria magna La Touche, Bull. B. O. C., **40**, 1920, p. 96.

Cotype.— No. 127,627, ♂; Lower Yangtse, Shaweishan Island; 13 April, 1908; La Touche Collection.

Cotype.— No. 127,628, ♀; Lower Yangtse, Shaweishan Island; 18 April, 1908; La Touche Collection.

Petrocincla leucocapilla Lafresnaye

now Monticola brevipes leucocapilla (Lafresnaye)

Petrocincla leucocapilla Lafresnaye, Rev. et Mag. Zoöl., 1852, p. 470.

Cotype.— No. 76,499, ♂; Lafresnaye Collection, no. 3,872; "Afr. mer. Betzonanas."

Cotype.— No. 76,469, ♀; Lafresnaye Collection, no. 3,873; "Afr. mer. Betzonanas."

This pair of birds Lafresnaye bought of Parzaduki (so stated on the labels). They are both still in fine condition. The male has the crown pale blue-gray in contrast with the general color of the upper parts, but not white. Lafresnaye's name thus antedates by many years *M. brevipes pretoriae* Gunning and Roberts. The Damaraland form with the white cap is, of course, *Monticola brevipes brevipes* (G. R. Waterhouse in J. E. Alexander, Exped. Africa, **2**, 1838, p. 263).

Lafresnaye's name appears to have been completely overlooked by all workers, not even appearing in Sherborn.

Enicurus guttatus bacatus Bangs and Phillips

now Enicurus maculatus bacatus Bangs and Phillips

Enicurus guttatus bacatus Bangs and Phillips, Bull. Mus. Comp. Zoöl., **58**, 1914, p. 292.

Type.— No. 62,033, ♀; Yunnan, Loukouchai; 14 February, 1911; Kobayashi Collection.

The two skins upon which this form is based have very large white spots above and large white neck bands. I have seen no Indian birds with the white spots so large. Very likely Rothschild is right in referring birds from western Yunnan to *Enicurus maculatus guttatus* Gould, but I cannot accept that identification of the Loukouchai specimens.

Judged by our material Rothschild renamed *bacatus* in his *Enicurus maculatus omissa* from Fohkien (Nov. Zoöl., **28**, 1921, p. 26).

Our two specimens of *bacatus* though taken in February and otherwise in nice feather, had not changed their primaries at their last moult. These are very brownish as compared with the rest of the wing and

badly worn and broken at the tips, hence affording too short a wing length measurement. Also, many Fohkien birds in our series, even with more perfect primaries have wings but little longer than in the Loukouchai examples. In all other measurements as well as in color and marking Fohkien birds are identical with the two skins of *bacatus*.

Pressing the wing down on the rule to try and conform to Rothschild's measurements I get—Fohkien, — ♀ ♀, wing; 104; 104; 104; 109; ♂ ♂, 104; 104; 105; 106; 108; 108; 114; 114. Kiangsu, ♂, 104. Yunnan, Loukouchai, ♂ (wing much broken and worn at tip), 97; ♂ (wing somewhat broken and worn at tip), 104.

I therefore believe that *bacatus* ranges from Kiangsu and Fohkien through Kwangtung and Kwangsi to southern Yunnan.

Ianthia practica Bangs and Phillips

now Ianthia rufilata practica Bangs and Phillips

Ianthia practica Bangs and Phillips, Bull. Mus. Comp. Zoöl., **58**, 1914, p. 292.

Type.— No. 62,035, ♂; Yunnan, Loukouchai; 14 February, 1911; Kobayashi Collection.

Kittacincla barbouri Bangs and Peters

Kittacincla barbouri Bangs and Peters, Occ. Papers, Bost. Soc. N. H., **5**, 1927, p. 239.

Type.— No. 235,959, ♂; Maratua Island off east coast of Borneo; March, 1926; E. Mjöberg.

† Cossypha nigrocapilla Guérin

= Bessonornis semirufa (Rüppell)

Cossypha nigrocapilla Guérin, Rev. Zoöl., 1843, p. 162.

Type.— No. 76,042; Lafresnaye Collection, no. 3,936; "Abyssinie."

Petrocincla semirufa Rüppell, Neue Wirbelthiere, 1835, p. 81.

Lafresnaye's written label for this specimen is similar to all that he wrote for the Ferret and Galinier birds from Abyssinia, and shows that he was really associated with Guérin in the naming of the new forms.

Turdus niveicapillus Lafresnaye

now Bessonornis niveicapillus niveicapillus (Lafresnaye)

Turdus nivei-capillus Lafresnaye, Mém. Sci. Acad. Falaise, Essai Nouv. Man., 1838, p. 16.

Type.— No. 76,465; Lafresnaye Collection, no. 3,938; "Senegal."

Penard and I (Bull. Mus. Comp. Zoöl., **63**, 1919, p. 31) have pointed out that Lafresnaye's name having many years precedence, must be used for the species usually known as *Cossypha verticalis* Hartlaub.

Cossypha gutturalis Guérin

now Irania gutturalis (Guérin)

Type.— No. 76,041; Lafresnaye Collection, no. 3,933; "Abyssinie."

The label in Lafresnaye's hand, reads — "*Cossypha gutturalis* Guér. et nob. rev., 1843, p. 162, Abyssinie."

Turdus cinnamomeiventris Lafresnaye

now Thamnolaea cinnamomeiventris (Lafresnaye)

Turdus cinnamomeiventris Lafresnaye, Mag. Zoöl., 1836, pls. 55 and 56, text and plates.

Cotype.— No. 76,470; Lafresnaye Collection, no. 3,943; "♂, Cap. b. spei, Verreaux, peutêtre de l'interieur."

Cotype.— No. 76,471; Lafresnaye Collection, no. 3,945; "♀, ou jeune, Cap. b. spei.; Verreaux, peutêtre de l'interieur."

Pratincola torquata yunnanensis La Touche

now Saxicola torquata yunnanensis (La Touche)

Pratincola torquata yunnanensis La Touche, Bull. B. O. C., **43**, 1923, p. 134.

Cotype.— No. 128,029, ♂; Yunnan, Shuitang; 1 May, 1921; La Touche Collection.

Cotype.— No. 128,030, ♀; Yunnan, Mengtsz; 3 November, 1920; La Touche Collection.

† Saxicola leucuroides Guérin

= Oenanthe lugubris (Rüppell)

Saxicola leucuroides Guérin, Rev. Zoöl., 1843, p. 161.

Type.— No. 76,043; Lafresnaye Collection, no. 3,978; "Abyssinie."

Saxicola lugubris Rüppell, Neue Wirbelthiere, 1835, p. 77, pl. 28.

PRUNELLIDAE

Prunella fulvescens nadiae Bangs and Peters

Prunella fulvescens nadiae Bangs and Peters, Bull. Mus. Comp. Zoöl., **68**, 1928, p. 355.

Type.— No. 238,898, ♂; southwestern Kansu, Tao River valley near Choni; February, 1926; J. F. Rock.

SYLVIIDAE

† Locustella styani La Touche

= Locustella pleskei (Taczanowski)

Locustella styani La Touche, Bull. B. O. C., **16**, 1905, p. 21.

Type.— No. 128,967, ♀; Fohkien, Foochow; 2 October, 1895; La Touche Collection.

Locustella pleskei Taczanowski, P. Z. S., 1889, p. 620.

Acrocephalus tangorum La Touche

Acrocephalus tangorum La Touche, Bull. B. O. Club, **31**, 1912, p. 568.

Type.— No. 129,109, ♂; Northeast Chihli, Chinwangtao; 1 September, 1912; La Touche Collection.

Tribura thoracica davidi La Touche

Tribura thoracica davidi La Touche, Bull. B. O. C., **43**, 1923, p. 168.

Type.— No. 129,130, ♂; Northeast Chihli, Chinwangtao; 1 June, 1917; La Touche Collection.

Orthotomus sutorius inexpectatus La Touche

Orthotomus sutorius inexpectatus La Touche, Bull. B. O. C., **43**, 1922, p. 42.

Cotype.— No. 129,149, ♂; Yunnan, Mengtsz; 18 November, 1920; La Touche Collection.

Cotype.— No. 129,150, ♀; Yunnan, Mengtsz; 25 November, 1920; La Touche Collection.

Kinnear (Ibis, 1929, p. 320) considers *inexpectatus* the same as *longicauda* of south China. Upon comparing long series from southern Yunnan and Fohkien, however, I can detect exactly the differences

pointed out by La Touche, though I must admit that they are slight. Kinnear is wrong in stating that La Touche had but a single specimen upon which he based the form. In reality La Touche had thirteen!

Orthotomus ruficeps nuntius Bangs

Orthotomus ruficeps nuntius Bangs, Bull. Mus. Comp. Zoöl., **65**, 1922, p. 82.

Type.— No. 57,529, ♂; Philippine Islands, Cagayan de Sula; 2 July, 1911; W. C. Forbes.

Opifex altus Friedmann

now Artisornis ruficeps altus (Friedmann)

Opiferus altus Friedmann, Proc. New Eng. Zoöl. Club, **10**, 1927, p. 4.
Artisornis ruficeps altus (Friedmann), Ibis, 1928, p. 478.

Type.— No. 237,501, ♀; Tanganyika Territory, Uluguru Mountains Nyingwa; 19 October, 1926; A. Loveridge.

The generic name *Opifex* was found to be preoccupied by *Opifex* Hutton, 1902 (*Culicidae*), and was replaced by *Artisornis* Friedmann, Ibis, 1928, p. 93. It developed later that the species had been described by Reichenow (Orn. Monatsb. **16**, 1901, p. 119) as *Apalis ruficeps*, the type locality being Mlalo, Usambara Mountains. But the species is clearly not an *Apalis*, and the genus *Artisornis* stands. Birds from the Uluguru Mts. are subspecifically distinct from typical *ruficeps*.

Cisticola exilis courtoisi La Touche

Cisticola exilis courtoisi La Touche, Handbook, Birds of Eastern China, pt. 3, 1926, p. 237.

Type.— No. 129,164, ♂; Yunnan, Hokow; 28 March, 1921; La Touche Collection.

† Cisticola alleni Mearns

= Cisticola cinereola cinereola Salvadori

Cisticola alleni Mearns, Smiths. Misc. Coll., **56**, 1911, p. 3.

Type.— No. 56,127, ♂; Kenya Colony, Meru River; 12 August, 1909; G. M. Allen.

Cisticola cinereola Salvadori, Ann. Mus. Genova, **26**, 1888, p. 254.

Admiral Lynes has examined and identified this type as above.

† Cisticola difficilis Mearns

= Cisticola chiniana heterophrys Oberholser

Cisticola difficilis Mearns, Smiths. Musc. Coll., **56**, 1911, p. 5.

Type.— No. 56,129, ♀; Kenya Colony, Lakiundu, north of Mt. Kenia; 7 September, 1909; G. M. Allen.

Cisticola heterophrys Oberholser, Ann. Carnegie Mus., **3**, 1906, p. 496.

Admiral Lynes has also identified this specimen.

Megalurus palustris forbesi Bangs

Megalurus palustris forbesi Bangs, Proc. New Eng. Zoöl. Club, **7**, 1919, p 5.

Type.— No. 64,247, ♂; Philippine Islands, Luzon, Baguio, Benquet; 24 April, 1913; W. C. Forbes.

† Turdinus spadix Friedmann

= Bradypterus usambarae (Grote)

Turdinus spadix Friedmann, Proc. New Eng. Zoöl. Club, **10**, 1927, p. 3.

Type.— No. 237,500, ♂; Tanganyika Territory, Uluguru Mountains, Nyingwa; 14 October, 1926; A. Loveridge.

Bradypterus usambarae Grote, J. f. O., 1917, p. 391.

Reguloides maculipennis debilis Thayer and Bangs

now Phylloscopus maculipennis debilis (Thayer and Bangs)

Reguloides maculipennis debilis Thayer and Bangs, Mem. Mus. Comp. Zoöl., **40**, 1912, p. 180.

Type.— No. 52,502, ♀; western Szechuan, Kiating; 26 November, 1908; W. R. Zappey.

Reguloides pulcher vegetus Bangs

now Phylloscopus pulcher vegetus (Bangs)

Reguloides pulcher vegetus Bangs, Proc. Biol. Soc. Washington, **26**, 1913, p. 95.

Type.— No. 52,303, ♀; western Szechuan, Yachiakun; 14 July, 1908; W. R. Zappey.

Phylloscopus proregulus yunnanensis La Touche

now Phylloscopus yunnanensis La Touche

Phylloscopus proregulus yunnanensis La Touche, Bull. B. O. C., **43**, 1922, p. 21.

Type.— No. 129,349, ♂; Yunnan, Mengtsz; 16 October, 1920; La Touche Collection.

Stuart Baker (Fauna of British India, Birds, **2**, 1924, p. 467), declared that *P. proregulus yunnanensis* La Touche is the same as *Phylloscopus proregulus forresti* Rothschild. Rothschild, however, two years later includes both forms, and elevates *yunnanensis* to the rank of a full species (Novit. Zoöl., **33**, no. 3, 1926, p. 286 and 287)!

Acanthopneuste trochiloides claudiae La Touche

now Phylloscopus reguloides claudiae (La Touche)

Acanthopneuste trochiloides claudiae La Touche, Bull. B. O. C., **43**, 1922, p. 22.

Cotype.— No. 129,563, ♂; Yunnan, Mengtsz; 15 October, 1920; La Touche Collection.

Cotype.— No. 129,564, ♀; Yunnan, Mengtsz; 14 October, 1920; La Touche Collection.

Gyldenstolpe has shown conclusively (Bull. B. O. C., **46**, 1925, p. 46–47) that the bird we all have been calling *Phylloscopus trochiloides* Sundevall is in reality what has long been known by the name of *P. lugubris* Blyth, and that *P. reguloides* Blyth, therefore, must take the place of *P. trochiloides auctorum*.

Acanthopneuste trochiloides disturbans La Touche

now Phylloscopus reguloides disturbans (La Touche)

Acanthopneuste trochiloides disturbans La Touche, Bull. B. O. C., **43**, 1922, p. 22.

Cotype.— No. 129,608, ♂; Yunnan, Mengtsz; 10 September, 1920; La Touche Collection.

Cotype.— No. 129,609, ♀; Yunnan, Mengtsz; 10 September, 1920; La Touche Collection.

Cryptolopha ricketti Slater

now Phylloscopus trivirgatus ricketti (Slater)

Cryptolopha ricketti Slater, Ibis, 1897, p. 174, pl. 4, fig. 2.

Cotype.— No. 128,858, ♀; Northwest Fohkien, Kuatun; 20 May, 1896; La Touche Collection.

This specimen is marked "♀, type." The male cotype is probably in the British Museum.

† Cryptolopha trivirgatus eiuncidus Bangs and Phillips
= Phyllopscopus trivirgatus ricketti (Slater)

Cryptolopha trivirgatus eiuncidus Bangs and Phillips, Bull. Mus. Comp. Zoöl., **58**, no. 6, 1914, p. 282.

Type.— No. 61,985, ♂; Yunnan, Mengtsz; 16 September, 1910; Kobayashi Collection.

Cryptolopha ricketti Slater, Ibis, 1897, p. 174, pl. 4, fig. 2.

Cryptolopha burkii cognita La Touche
now Seicercus cognita (La Touche)

Cryptolopha burkii cognita La Touche, Bull. B. O. C., **43**, 1923, p. 42.

Cotype.— No. 128,849, ♂; Northwestern Fohkien, Kuatun; 6 April, 1898; La Touche Collection.

The ♀ cotype is in the British Museum.

Cryptolopha burkii intermedia La Touche
now Seicercus intermedius (La Touche)

Cryptolopha burkii intermedia La Touche, Bull. B. O. C., **7**, 1898, p. 37.

Type.— No. 128,836, ♂; northwestern Fohkien, Kautun; 19 September, 1896.

The specimen originally designated as the ♀ cotype, now in the British Museum, does not belong to this species, but is an example of *Seicercus burkii latouchei* Bangs.

Seicercus burkii latouchei Bangs

Seicercus burkii latouchei Bangs, Proc. New Eng. Zoöl. Club, **11**, 1929, p. 4.

Type.— No. 128,830, ♂; northwestern Fohkien, Kuatun; 11 May, 1898; La Touche Collection.

Cryptolopha burkii distincta La Touche
now Seicercus burkii distinctus (La Touche)

Cryptolopha burkii distincta La Touche, Bull. B. O. C., **43**, 1922, p. 41.

Cotype.— No. 128,843, ♂; Yunnan, Mengtsz; 25 March, 1921; La Touche Collection.

Cotype.— No. 128,844, ♀; Yunnan, Mengtsz; 21 April, 1921; La Touche Collection.

Cryptolopha castaneiceps laurentei La Touche

now Seicercus castaneiceps laurentei (La Touche)

Cryptolopha castaneiceps laurentei La Touche, Bull. B. O. C., **42**, 1921, p. 53.

Type.— No. 128,896, ♂; Yunnan, Mengtsz; 21 March, 1921; La Touche Collection.

Apalis chapini Friedmann

Apalis chapini Friedmann, Proc. New Eng. Zoöl. Club, **10**, 1928, p. 47.

Type.— No. 237,761, ♂; Tanganyika Territory, Uluguru Mountains, Nyingwa; 14 October, 1926; A. Loveridge.

Sylvietta brachyura Lafresnaye

now Sylvietta micrura brachyura (Lafresnaye)

Sylvietta brachyura Lafresnaye, Rev. Zoöl., 1839, p. 258.

Type.— No. 76,466; Lafresnaye Collection, no. 3,694; Senegal.

Verreaux listed this specimen and another, No. 3,693 in his catalogue as *Sylvietta microura*. Number 3,693 cannot now be found and probably has been destroyed. *Sylvietta crombec* Lafresnaye (*l.c.*, p. 258) is based upon Levaillant's plate 135, and, therefore, there is no type. Lafresnaye had no specimen of it.

† Sylvietta icteropygialis Lafresnaye

= Eremomela flaviventris flaviventris (Burchell)

Sylvietta icteropygialis Lafresnaye, Rev. Zoöl., 1839, p. 258.

Type.— No. 83,386; Lafresnaye Collection, no. 3,742; "Afr. austr. Riv. d'orange."

Sylvia flaviventris Burchell, Trav. S. Afr., **1**, 1824, p. 335.

Reichenow (Vög. Afr., **3**, p. 641) places Lafresnaye's name with a query in the synonymy of *Eremomela albigularis* (Finsch and Hartlaub) With Lafresnaye's type still in good condition before me, it is readily identified as *E. f. flaviventris*.

CETTIA SINENSIS La Touche

now HORORNIS FORTIPES SINENSIS (La Touche)

Cettia sinensis La Touche, Bull. B. O. C., **7**, 1898, p. 37.

Type.— No. 129,665, ♂; Fohkien, Foochow; 10 November, 1895; La Touche Collection.

UROSPHENA LAURENTEI La Touche

now HOREITES PALLIDIPES LAURENTEI (La Touche)

Urosphena laurentei La Touche, Bull. B. O. C., **42**, 1921, p. 30.

Type.— No. 129,731, ♂; Yunnan, Poutoutsing; 12 April, 1921; E. P. Laurente.

SUYA CRINIGERA BANGSI La Touche

Suya crinigera bangsi La Touche, Bull. B. O. C., **42**, 1921, p. 53.

Type.— No. 129,757, ♂; Yunnan, Mengtsz; 19 September, 1920; La Touche Collection

SUYA CRINIGERA PARVIROSTRIS La Touche

now SUYA PARVIROSTRIS (La Touche)

Suya crinigera parvirostris La Touche, Bull. B. O. C., **42**, 1921, p. 53.

Type.— No. 129,777, ♂; Yunnan, Shuitang; 1 May, 1921; La Touche Collection.

PRINIA INORNATA EXTER Thayer and Bangs

Prinia inornata exter Thayer and Bangs, Mem. Mus. Comp. Zoöl., **40**, 1912, p. 182, pl. 5, figs. 4 and 5.

Type.— No. 52,580, ♂; western Szechuan, Hokow; 4 May, 1908; W. R. Zappey.

† POLIOPTILA NIGRICEPS RESTRICTA Brewster

= POLIOPTILA NIGRICEPS (Baird)

Polioptila nigriceps restricta Brewster, Auk, **6**, 1889 (April), p. 97; separates issued in advance, January 31, 1889.

Type.— No. 214,384, ♂; Sonora, Alamos; 7 March, 1888; M. A. Frazar.

Polioptila nigriceps Baird, Rev. Am. Birds, 1864, p. 69.

POLIOPTILA CALIFORNICA Brewster

now POLIOPTILA MELANURA CALIFORNICA Brewster

Polioptila californica Brewster, Bull. Nutt. Orn. Club, **6**, 1881, p. 103.

Type.— No. 201,489, ♂; California, San Bernardino County; 28 March, 1878.

VIREONIDAE

VIREO INSULANUS Bangs

now VIREO FLAVOVIRIDIS INSULANUS (Bangs)

Vireo insulanus Bangs, Proc. New Eng. Zoöl. Club, **3**, 1902, p. 73.

Type.— No. 104,947, ♀; San Miguel Island, Pearl Islands, Bay of Panama; 29 April, 1900; W. W. Brown.

† VIREO BOGOTENSIS Bryant

= VIREO VIRESCENS Vieillot

Vireo bogotensis Bryant, Proc. Bost. Soc. N. H., **7**, 1860, p. 227.

Type.— No. 47,159; Bogotá.

Vireo virescens Vieillot, Ois. Amer. Sept., **1**, 1807, p. 84, pl. 53.

† MUSCICAPA MELODIA Wilson

= VIREO GILVA GILVA (Vieillot)

Muscicapa melodia Wilson, Am. Orn., **5**, 1812, p. 36, pl. 42, fig. 2.

Type.— No. 67,866; from the old Peale Museum.

Muscicapa gilva Vieillot, Ois. Amer. Sept., **1**, 1807, p. 65, pl. 34.

VIREOSYLVA GILVA BREWSTERI Ridgway

now VIREO GILVA BREWSTERI (Ridgway)

Vireosylva gilva brewsteri Ridgway, Bull. U. S. Nat. Mus., no. 50, 1904, p. 158.

Type.— No. 221,811, ♂; Chihuahua, Bravo; 24 July, 1888; M. A. Frazar.

HYLOPHILUS LEUCOPHRYS Lafresnaye

now VIREO LEUCOPHRYS LEUCOPHRYS (Lafresnaye)

Hylophilus leucophrys Lafresnaye, Rev. Zoöl., 1844, p. 81.

Type.— No. 76,541; Lafresnaye Collection, no. 4,384; Colombia.

Vireosylva josephae chiriquensis Bangs

now Vireo leucophrys chiriquensis (Bangs)

Vireosylva josephae chiriquensis Bangs, Proc. New Eng. Zoöl. Club, **4**, 1903, p. 9.

Type.— No. 108,692, ♂; Panama, Boquete; 8 April, 1901; W. W. Brown.

Vireo solitarius alticola Brewster

Vireo solitarius alticola Brewster, Auk, **3**, 1886, p. 111.

Type.— No. 210,577, ♂; North Carolina, Highlands; 29 May, 1885; W. Brewster.

Vireo solitarius lucasanus Brewster

Vireo solitarius lucasanus Brewster, Auk, **8**, 1891 (April), p. 147; separates issued in advance, February 17, 1891.

Cotype.— No. 215,504, ♂; Lower California, San José del Rancho; 15 July, 1887; M. A. Frazar.

Cotype.— No. 215,521, ♂; Lower California, Triumfo; 23 December, 1887; M. A. Frazar.

Cotype.— No. 215,510, ♀; Lower California, San José del Rancho; 6 July, 1887; M. A. Frazar.

† Muscicapa cantatrix Wilson

= Vireo griseus griseus (Boddaert)

Muscicapa cantatrix Wilson, Am. Orn. **2**, 1810, p. 166, pl. 18, fig. 6.

Type.— No. 67,867; from the old Peale Museum.

Tanagra grisea Boddaert, Table Pl. Enl., 1783, p. 45.

Vireo bermudianus Bangs and Bradlee

now Vireo griseus bermudianus (Bangs and Bradlee)

Vireo bermudianus Bangs and Bradlee, Auk, **18**, 1901, p. 252.

Type.— No. 39,131, ♀; Bermudas, Hamilton; 1 February, 1901; T. S. Bradlee.

Lanivireo crassirostris Bryant

now Vireo crassirostris crassirostris (Bryant)

Lanivireo crassirostris Bryant, Proc. Bost. Soc. N. H., **7**, 1859, p. 112.

Cotype.— No. 46,779, ♂; Bahamas, Nassau; April 10; H. Bryant.

Cotype.— No. 46,780, ♂; Bahamas, Nassau; March 20; H. Bryant.

Bryant based his new species on three specimens taken by himself at Nassau; the third cotype is in the collection of the United States National Museum.

Vireo huttoni stephensi Brewster

Vireo huttoni stephensi Brewster, Bull. Nutt. Orn. Club, **7**, 1882, p. 142.

Type.— No. 205,728, ♂; Arizona, Chiricahua Mountains; 14 March, 1881.

Vireo huttoni cognatus Ridgway

Vireo huttoni cognatus Ridgway, Bull. U. S. Nat. Mus., no. 50, 1904, p. 199.

Type.— No. 215,527, ♂; Lower California, Sierra de la Laguna; 5 May, 1887; M. A. Frazar.

Hylophilus semibrunneus Lafresnaye

now Hylophilus semibrunneus semibrunneus Lafresnaye

Hylophilus semi-brunneus Lafresnaye, Rev. Zoöl., 1845, p. 341.

Type.— No. 76,538; Lafresnaye Collection, No. 4,380; "Bogotá."

Hylophilus flavipes Lafresnaye

now Hylophilus flavipes flavipes Lafresnaye

Hylophilus flavipes Lafresnaye, Rev. Zoöl., 1845, p. 342.

Type.— No. 76,539; Lafresnaye Collection, No. 4,382; "Bogotá."

Cyclarhis flaviventris Lafresnaye

now Cyclarhis flaviventris flaviventris Lafresnaye

Cyclarhis flaviventris Lafresnaye, Rev. Zoöl., 1842, p. 133.

Type.— No. 76,537; Lafresnaye Collection, No. 4,399; "sta. cruce, Mexico."

Cyclarhis flavipectus canticus Bangs

Cyclarhis flavipectus canticus Bangs, Proc. Biol. Soc. Washington, **12**, 1898, p. 142.

Type.— No. 105,462, ♂; Colombia, Santa Marta; 28 January, 1898; W. W. Brown.

Cyclarhis nigrirostris Lafresnaye

now Cyclarhis nigrirostris nigrirostris Lafresnaye

Cyclarhis nigrirostris Lafresnaye, Rev. Zoöl., 1842, p. 133.

Cotype.— No. 76,534; Lafresnaye Collection, No. 4,402; "Colombie."

Cotype.— No. 76,535; Lafresnaye Collection, No. 4,403; "Colombie."

Lafresnaye wrote labels exactly alike for these two specimens, so I, therefore, consider them cotypes. Number 4,402, however, was the bird figured on plate 33 of the magazine for 1843. It has a blackish cinnamon frontal band as shown in the plate, whereas Number 4,403 has the frontal band much more rufous.

PTILOGONATIDAE

Phainopepla nitens lepida Van Tyne

Phainopepla nitens lepida Van Tyne, Occ. Papers Bost. Soc. N. H., **5**, 1925, p. 149.

Type.— No. 200,653, ♂; California, Riverside; 14 May, 1878.

ARTAMIDAE

† Ocypterus mentalis Peale

= Artamus mentalis Jardine

Ocypterus mentalis Peale, U. S. Expl. Exped., 1848, p. 84.

Cotype.— No. 75,750; Fiji Islands; U. S. Expl. Exped.

Artamus mentalis Jardine, Ann. Mag. N. H., **16**, 1845, p. 174, pl. 8.

Peale's name for this species was introduced independently, he apparently being unaware that the same name for the same species had already been used by Jardine.

VANGIDAE

Vanga xenopirostris Lafresnaye

now Xenopirostris xenopirostris (Lafresnaye)

Vanga xenopirostris Lafresnaye, Rev. et Mag. Zoöl., 1850, p. 107, pl. 1.

Type.— No. 74,864; Lafresnaye Collection, no. 5,314; "Madagascar?"

Vanga curvirostris cetera Bangs

Vanga curvirostris cetera Bangs, Proc. New Eng. Zoöl. Club, **10**, 1928, p. 107.

Type.— No. 78,133; southwest Madagascar, Tulear; August, 1915; F. R. Wulsin.

LANIIDAE

Gymnorhina tibicen papuana Bangs and Peters

Gymnorhina tibicen papuana Bangs and Peters, Bull. Mus. Comp. Zoöl., **67**, 1926, p. 431.

Type.— No. 99,653, ♀; southwest New Guinea, Princess Marianne Straits; 12 November, 1923; T. Jackson.

Lanius bucephalus sicarius Bangs and Peters

Lanius bucephalus sicarius Bangs and Peters, Bull. Mus. Comp. Zoöl., **68**, 1928, p. 358.

Type.— No. 239,069, ♀; southwestern Kansu, Mountains in the Tao valley near Choni; May, 1925; J. F. Rock.

Malaconotus alius Friedmann

Malaconotus alius Friedmann, Proc. New Eng. Zoöl. Club, **10**, 1927, p. 5.

Type.— No. 237,504, ♂; Tanganyika Territory, Uluguru Mountains, Bagilo; 20 September, 1926; A. Loveridge.

† Lanius boubou Guérin

= Laniarius rufiventris rufiventris (Swainson)

Lanius boubou Guérin, Rev. Zoöl., 1843, p. 161.

Type.— No. 76,078; Lafresnaye Collection, No. 5,315; "Cap. B. esp."

Malaconotus rufiventris Swainson, Classification of Birds, **2**, 1837, p. 220.

For this specimen Lafresnaye wrote this label — "*Lanius boubou* nob. rev. 1843, p. 161, Le Boubou Vaill. afr. pl. 68, confondue à tort par Vieillot D. 26, 137 sous le nom de Lan. aethiopicus, avec cette dernière qui est particulié a l'abyssinie ou Bruce l'a decouvrit et qui est décrite par Montbeillard sous le nom de Merle noir et blanc d'abyssinie enl. IV, p. 123. Cap. B. esp."

PARIDAE

Parus hudsonicus littoralis Bryant

Parus hudsonicus var. *littoralis* Bryant, Proc. Bost. Soc. N. H., **9**, 1865, p. 369.

Cotype.— No. 46,976, ♂; Nova Scotia, Yarmouth; July 7; H.Bryant.

Cotype.— No. 46,977, ♀; Nova Scotia, Yarmouth; July 7; H.Bryant.

Cotype.— No. 46,978, ♂; Nova Scotia, Yarmouth; July 7; H.Bryant.

Cotype.— No. 46,979, juv.; Nova Scotia, Yarmouth; July 7; H. Bryant.

Cotype.— No. 46,980, juv.; Nova Scotia, Yarmouth; July 7; H. Bryant.

† Penthestes hudsonicus nigricans C. W. Townsend

= Parus hudsonicus littoralis Bryant

Penthestes hudsonicus nigricans C. W. Townsend, Auk, **33**, 1916, p. 74.

Type.— No. 69,431, ♂; Labrador, Shekatika; 23 July, 1915; C. W. Townsend.

Parus hudsonicus var. *littoralis* Bryant, Proc. Bost. Soc. N. H., **9**, 1865, p. 369.

The sooty cap which led Townsend to separate this supposed form is, in my opinion, a characteristic of the young bird in first winter plumage, and not a subspecific character.

Penthestes sclateri eidos Peters

now Parus sclateri eidos (Peters)

Penthestes sclateri eidos Peters, Proc. New Eng. Zoöl. Club, **9**, 1927, p. 113.

Type.— No. 205,811, ♂; Arizona, Chiricahua Mountains; 29 March, 1881.

Parus carolinensis impiger Bangs

Parus carolinensis impiger Bangs, Proc. New Eng. Zoöl. Club, **4**, 1903, p. 1.

Type.— No. 111,854, ♀; Florida, Deep Creek; 19 March, 1901; C. J. Maynard.

Parus dichrous arceuthinus Bangs and Peters

Parus dichrous arceuthinus Bangs and Peters, Bull. Mus. Comp. Zoöl., **68**, 1928, p. 361.

Type.— No. 50,822, ♂; western Szechuan, Washan Mountain; 4 June, 1908; W. R. Zappey.

† Parus bicolor floridanus Bangs

= Parus bicolor (Linné)

Parus (Lophophanes) bicolor floridanus Bangs, Auk, **15**, 1898, p. 181.

Type.— No. 103,023, ♂; Florida, Clearwater; 29 March, 1874; C. J. Maynard.

Parus bicolor Linné, Syst. Nat., ed. 12, 1766, p. 340.

The Florida bird cannot stand as a subspecies, I now believe. The differences are altogether too slight.

Parus ater kuatunensis La Touche

Parus ater kuatunensis La Touche, Bull. B. O. C., **44**, 1913, p. 33.

Cotype.— No. 128,225, ♂; northwest Fohkien, Kuatun; February, 1913; La Touche Collection.

Cotype.— No. 128,226, ♀; northwest Fohkien, Kuatun; 1 November, 1907; La Touche Collection.

Periparus phaeonotus gaddi Sarudny

now Parus ater gaddi (Sarudny)

Periparus phaeonotus gaddi Sarudny, J. f. O., **59**, 1911, p. 236.

Cotype.— No. 248,919, ♀; Persia, Robat-i-sefit; 12 October, 1903.

This specimen was received by us from von Tschusi, who assured us that it was one of the "types." As no holotype was designated by Sarudny, and the above example is one from the original series, it must be considered a cotype.

Parus major artatus Thayer and Bangs

Parus major artatus Thayer and Bangs, Bull. Mus. Comp. Zoöl., **52**, 1909, p. 140.

Type.— No. 50,000, ♂; Hupeh, Ichang; 1 March, 1907; W. R. Zappey.

Parus major altarum La Touche

Parus major altarum La Touche, Bull. B. O. C., **43**, 1922, p. 43.

Cotype.— No. 128,158, ♂; Yunnan, Mengtsz; 21 October, 1920; La Touche Collection.

Cotype.— No. 128,159, ♀; Yunnan, Mengtsz; 6 October, 1920; La Touche Collection.

Parus major fohkienensis La Touche

Parus major fohkienensis La Touche, Bull. B. O. C., **43**, 1923, p. 104.

Cotype.— No. 128,184, ♂; northwest Fohkien, Kuatun; 21 May, 1896; La Touche Collection.

Cotype.— No. 128,185, ♀; northwest Fohkien, Kuatun; 3 April, 1898; La Touche Collection.

Stresemann (J. f. O., **77**, 1929, p. 327) places *fohkienensis* as a synonym of *artatus*. To this I cannot agree. With the types of both forms and long series of skins before me, I cannot but recognize *fohkienensis* as perfectly distinct from *artatus*. In color the two are very similar, but *artatus* is a much larger bird — so much larger in fact that I do not find any overlapping in the measurements of the two.

† Parus stejnegeri Bangs

= Parus nigriloris Hellmayr

Parus stejnegeri Bangs, Bull. Mus. Comp. Zoöl., **36**, 1901, p. 267.

Type.— No. 37,392, ♂; Loo Choo Islands, Ishigaki Island; 27 February, 1899.

Parus nigriloris Hellmayr, Orn. Monatsber., **8**, 1900, p. 139.

Parus monticolus yunnanensis La Touche

Parus monticolus yunnanensis La Touche, Bull. B. O. C., **42**, 1921, p. 51.

Cotype.— No. 128,128, ♂; Yunnan, Milati; 20 January, 1921; La Touche Collection.

Cotype.— No. 128,129, ♀; Yunnan, Milati; 20 January, 1921; La Touche Collection.

† Parus quadrivittatus Lafresnaye

= Parus elegans elegans Lesson

Parus quadrivittatus Lafresnaye, Rev. Zoöl., 1840, p. 129.

Type.— No. 76,233; Lafresnaye Collection, No. 2,769; "Manilla aut in India."

Parus elegans Lesson, Traité d'Orn., 1831, p. 456.

Parus leuconotus Guérin

Parus leuconotus Guérin, Rev. Zoöl., 1843, p. 162.

Cotype.— No. 76,045; Lafresnaye Collection, No. 2,749; Lafresnaye's label for this specimen reads — "Parus leuconotus guérin nob. ♂, adulte, abyssinie."

Cotype.— No. 76,103; Lafresnaye Collection, No. 2,750; label — "Parus leuconotus guér. nob. abyssinie." [added] "Parus *leuconotus* à figurer."

M. C. Z., No. 76,103 is as stated on its label, the bird figured in the atlas. A third specimen, No. 2,751, Lafresnaye Collection, is a juvenal of a brownish color with a grayish back, and is not a cotype.

Parus albiventris curtus Friedmann

Parus albiventris curtus Friedmann, Occ. Papers Bost. Soc. N. H., **5**, 1926, p. 217.

Type.— No. 232,685, ♀; Kenya Colony, Taveta; 13 April, 1925; H. Friedmann.

Parus flavocristatus Lafresnaye

now Melanochlora sultanea flavocristata (Lafresnaye)

Parus flavo-cristatus Lafresnaye, Mag. Zoöl., 1837, pl. 80.

Type.— No. 76,254; Lafresnaye Collection, No. 4,417; "îles de la Sonde."

The wing of the type measures exactly 100 mm., and both it and a second specimen (received by Lafresnaye at a much later date and not a cotype, Lafresnaye No. 4,418) belong to the small form inhabiting Tenasserim, Malacca, Sumatra, etc.

Melanochlora sultanea seorsa Bangs

Melanochlora sultanea seorsa Bangs, Proc. New Eng. Zoöl. Club, **9**, 1924, p. 23.

Type.— No. 88,000, ♂; Fohkien, Yenping; 29 March, 1921; H. C. Caldwell.

Sylviparus modestus occultus Thayer and Bangs

Sylviparus modestus occultus Thayer and Bangs, Mem. Mus. Comp. Zoöl., **40**, 1912, p. 185.

Type.— No. 50,745, ♀; western Szechuan, Kiating; 15 November, 1908; W. R. Zappey.

Sylviparus modestus ricketti La Touche

Sylviparus modestus ricketti La Touche, Bull. B. O. C., **43**, 1923, p. 104.

Type.— No. 128,341; northwest Fohkien, Kuatun; 19 October, 1896; La Touche Collection.

Aegithaliscus fuliginosus scurrula Bangs and Peters

Aegithaliscus fuliginosus scurrula Bangs and Peters, Bull. Mus. Comp. Zoöl., **68**, 1928, p. 363.

Type.— No. 50,968, ♂; Hupeh, Hsienshanhsien; 25 December, 1907; W. R. Zappey.

Psaltriparus plumbeus cecaumenorum Thayer and Bangs

Psaltriparus plumbeus cecaumenorum Thayer and Bangs, Proc. Biol. Soc. Washington, **19**, 1906, p. 20.

Type.— No. 114,724, ♂; Sonora, La Chumata; 22 May, 1905; W. W. Brown.

SITTIDAE

Sitta montium La Touche

now Sitta europaea montium La Touche

Sitta montium La Touche, Ibis, 1899, p. 404.

Cotype.— No. 128,308, ♂; northwest Fohkien, Kuatun; 7 April, 1898; La Touche Collection.

Cotype.— No. 128,309, ♀; northwest Fohkien, Kuatun; 19 April, 1898; La Touche Collection.

Sitta europaea obscura La Touche

now Sitta europaea nebulosa La Touche

Sitta europaea obscura La Touche, Bull. B. O. C., **42**, 1921, p. 31 (not *Sitta neumayeri obscura* Sarudny and Loudon).

Sitta europaea nebulosa La Touche, Bull. B. O. C., **42**, 1921, p. 55 (new name to replace *Sitta europaea obscura* La Touche preoccupied).

Type.— No. 123,317, ♂; Yunnan, Milati; 9 January, 1921; La Touche Collection.

Sitta carolinensis atkinsi Scott

Sitta carolinensis atkinsi Scott, Auk, **7**, 1890, p. 118.

Cotype.— No. 226,991, ♂; Florida, Tarpon Springs; 21 April, 1887; W. E. D. Scott.

Cotype.— No. 226,992, ♀; Florida, Tarpon Springs; 27 September, 1886; W. E. D. Scott.

Oberholser (Auk, **34**, 1917, pp. 181–187) upsets the names of the

White-breasted Nuthatch, throwing *atkinsi* into the synonymy of *carolinensis*, and naming as new a northern form, *cookei*.

This arrangement of the forms does not appear to me to interpret the facts as well as the old order of things as used by Ridgway in his Birds of North and Middle America.

The White-breasted Nuthatch, like so many other birds of eastern North America, shows a well-marked form in south Florida and another in the northern parts of its range, and between these extremes a long series of intermediates. Unfortunately its type locality, southern South Carolina, falls in this area of intermediates. Nevertheless the south Florida form stands wholly apart. In a very long series of skins, none show any approach to the northern bird; all are uniformly small, with dark gray backs, slender bills, and with the crown in the female black, not at all or very little grayish. From southern South Carolina another long series shows the breeding bird quite variable in all its characters, but all are larger than those from south Florida. In color and slenderness of bill some individuals approach very closely to Florida specimens, others again are much more like northern birds, with paler gray backs, stouter bills and with the female with a gray crown. Furthermore many birds from southern South Carolina taken in autumn or winter, perhaps migrants, are quite the same as northern killed examples. It seems to me, therefore, much better to allow the geographic aggregate *atkinsi* to bear one name, and to apply the other, *carolinensis*, to all birds from South Carolina northward.

In naming the northern bird *cookei*, Oberholser made the mistake of referring *Sitta atkinsi litorea* Maynard, from New River, North Carolina, taken November 24, and possibly a migrant, to the southern form. Maynard's type listed below is a female, with a wing of 88 mm., a stout bill, pale gray back and gray crown. I cannot see that it differs from northern birds. If a change in the names is to be made, and I see no need for one, Maynard's name must become available for the northern form.

† Sitta atkinsi litorea Maynard

= Sitta carolinensis carolinensis Latham

Sitta atkinsi litorea Maynard, Records of Walks and Talks with Nature, **8**, no. 1, 1916, p. 5, plate.

Type.— No. 80,160, ♀ ; North Carolina, New River; 24 November, 1900; C. J. Maynard.

Sitta carolinensis Latham, Index Ornith., **1**, 1790, p. 262.

Sitta carolinensis lagunae Brewster

Sitta carolinensis lagunae Brewster, Auk, **8**, 1891 (April), p. 149; separates issued in advance, February 17, 1891.

Cotype.— No. 214,691, ♂; Lower California, Sierra de la Laguna; 5 May, 1887; M. A. Frazar.

Cotype.— No. 214,705, ♀; Lower California, Sierra de la Laguna; 7 May, 1887; M. A. Frazar.

Sitta pygmaea chihuahuae Van Rossem

Sitta pygmaea chihuahuae Van Rossem, Proc. Biol. Soc. Washington, **42**, 1929, p. 177.

Type.— No. 115,701, ♂; Chihuahua, Mound Valley; 3 September, 1905; W. W. Brown, Jr.

Sitta pusilla caniceps Bangs

Sitta pusilla caniceps Bangs, Auk, **15**, 1898, p. 180.

Type.— No. 103,021, ♀; Florida, Clearwater; 25 March, 1874; C. J. Maynard.

This form was not recognized by Ridgway in Birds of North and Middle America. It seems to me, now, going over the ground again, to be perfectly good, and Howell has recently shown the form to be valid (Auk, **47**, 1930, p. 43).

ZOSTEROPIDAE

Zosterops erythropleura melanorhyncha La Touche

Zosterops erythropleura melanorhyncha La Touche, Bull. B. O. C., **42**, 1921, p.32.

Type.— No. 130,639, ♀; Yunnan, Mengtsz; 22 October, 1920; La Touche Collection.

Rothschild (Nov. Zoöl., **33**, 1926, p. 318) says of this bird that it is "either a freak or else a stray wanderer from a different breeding area than that of the typical race." After carefully comparing the type with a good series, I quite agree with Rothschild. The pity is that with one migrant individual, no definite conclusions can be drawn.

Zosterops abyssinica Guérin

now Zosterops abyssinica abyssinica Guérin

Zosterops abyssinica Guérin, Rev. Zoöl., 1843, p. 162.

Type.— No. 76,044; Lafresnaye Collection, no. 5,727; "Abyssinie."

The original label (written by Lafresnaye) for this specimen, reads — "Zosterops abyssinica guér. et nob. rev. 1843, p. 162 (Abyssinie)."

Zosterops forbesi Bangs

Zosterops forbesi Bangs, Bull. Mus. Comp. Zoöl., **65**, 1922, p. 83.

Type.— No. 86,368, ♂; Philippines, Camiguin, Mambajao; 2 August, 1921; Governor W. Cameron Forbes.

This bird, of course, represents only an island form, and I give it specific rank, simply because I do not know where species begin and end in that group of the genus to which this bird belongs.

† Zosterops aureiventer johannae La Touche

= Zosterops palpebrosa williamsoni Robinson and Kloss

Zosterops aureiventer johannae La Touche, Bull. B. O. C., **42**, 1921, p. 31.

Cotype.— No. 130,604, ♂; Yunnan, Mengtsz; 17 November, 1920.
Cotype.— No. 130,605, ♀; Yunnan, Mengtsz; 23 September, 1920.

Zosterops palpebrosa williamsoni Robinson and Kloss, Journ. Nat. Hist. Soc., Siam, **3**, 1919, p. 445.

DICAEIDAE

† Dicaeum leclancherii Lafresnaye

= Dicaeum celebicum Müller and Schlegel

Dicaeum leclancherii Lafresnaye, Rev. Zoöl., 1845, p. 94.

Type.— No. 89,082; Lafresnaye Collection, no. 5,814; ad. ♂; "Manado, Celebes."

Dicaeum celebicum Müller and Schlegel, Verh. Naturl. Gesch. Land en Volkenk., 1832–1844, p. 182.

Shortly after Lafresnaye published the description of this bird supposing it to be new, he was severely criticized in an article by Hartlaub, for making a synonym, so much so in fact, that Lafresnaye replied in print, explaining at some length why he had overlooked Müller and Schlegel's name.

NECTARINIIDAE

Arachnothera longirostris sordida La Touche

Arachnothera longirostris sordida La Touche, Bull. B. O. C., **42**, 1921, p. 32.

Type.— No. 130,588, ♂; Yunnan, Hokow; 31 March, 1921; La Touche Collection.

Anthreptes malaccensis mjobergi Bangs and Peters

Anthreptes malaccensis mjobergi Bangs and Peters, Occ. Papers Bost. Soc. of N. H., **5**, 1927, p. 240.

Type.— No. 235,952, ♂; Maratua Island; March, 1926; E. Mjöberg.

MELIPHAGIDAE

Myzomela nigriventris Peale

Myzomela nigriventris Peale, U. S. Expl. Exped., **8**, 1848, p. 150.

Cotype.— No. 75,728; Samoan Islands; T. R. Peale.

Peale did not mention how many specimens he took. Our cotype is a fine adult male.

Myzomela jugularis Peale

Myzomela jugularis Peale, U. S. Expl. Exped., **8**, 1848, p. 150.

Cotype.— No. 89,110, ♂; Fiji Islands; T. R. Peale.

Peale mentions several specimens; the one listed above, therefore, may be one of a small series, still extant.

† Ptilosus auritus Lafresnaye

= Notiomystis cincta (Du Bus)

Ptilosus auritus Lafresnaye, Rev. Zoöl., September, 1839, p. 257.

Type.— No. 76,199; Lafresnaye Collection, no. 5,641; "Nlle. Zelande."

Meliphaga cincta Du Bus, Bull. Acad. Sci. Brux, **6**, June, 1839, p. 295.

Anthornis incoronata Bangs

now Anthornis melanura incoronata Bangs

Anthornis incoronata Bangs, Proc. Biol. Soc. Wash., **24**, 1911, p. 23.

Type.— No. 40,008; Auckland Island.

† Entomiza olivacea Peale

= Leptomyza samoensis (Hombr. et Jacq.)

Entomiza? olivacea Peale, U. S. Expl. Exped., **8**, 1848, p. 145.

Cotype.— No. 75,732; Samoan Islands; T. R. Peale.

Merops samoensis Hombr. et Jacq., Ann. Sci. Nat. Paris, 1841, p. 314.

Of this species Peale probably secured several specimens.

MNIOTILTIDAE

† Certhia maculata Wilson

= Mniotilta varia (Linné)

Certhia maculata Wilson, Am. Orn., **3**, 1811, p. 23, pl. 19, fig. 3.

Type.— No. 67,868 [♂].

Motacilla varia Linné, Syst. Nat., ed. 12, 1766, p. 333.

Helminthophaga leucobronchialis Brewster

= Hybrid: Vermivora chrysoptera (Linné) × Vermivora pinus (Linné)

Helminthophaga leucobronchialis Brewster, American Sportsman, **5**, Oct. 1874, p. 33.

Type.— No. 202,622, ♂; Mass., Newtonville; 18 May, 1870; Wm. Brewster.

† Compsothlypis americana usneae Brewster

= Compsothlypis americana pusilla (Wilson)

Compsothlypis americana usneae Brewster, Auk, **13**, 1896, p. 44.

Type.— No. 205,392, ♂; Maine, Lake Umbagog; 14 May, 1881; Wm. Brewster.

Sylvia pusilla Wilson, Am. Orn. **4**, 1811, p. 17, pl. 28, fig. 3.

Compsothlypis pulchra Brewster

now Compsothlypis pitiayumi pulchra Brewster

Compsothlypis pulchra Brewster, Auk, **6**, 1889 (April), p. 93; separates issued in advance, January 31, 1889.

Cotype.— No. 214,379, ♂; Chihuahua, Hacienda de San Rafael; 8 May, 1888; M. A. Frazar.

Cotype.— No. 214,380, ♀; Chihuahua, Hacienda de San Rafael; 14 May, 1888; M. A. Frazar.

Dendrioca aestiva sonorana Brewster

Dendroica aestiva sonorana Brewster, Auk, **5**, 1888, p. 137.

Cotype.— No. 214,151, ♂; Sonora, near Oposura; 7 April, 1887; J. C. Cahoon.

Cotype.— No. 214,152, ♀; Sonora, near Oposura; 14 April, 1887; J. C. Cahoon.

Dendroica aestiva ineditus Phillips

Dendroica aestiva ineditus Phillips, Auk, **28**, 1911, p. 85.

Type.— No. 49,970, ♂; Tamaulipas, Matamoros; 19 August, 1908; F. B. Armstrong.

Dendroica petechia alsoisa Peters

Dendroica petechia alsoisa Peters, Proc. New Eng. Zoöl. Club, **9**, 1926, p. 41.

Type.— No. 112,651, ♂; Grenadines, Prune Island; 28 March, 1904; Austin H. Clark.

Dendroica caerulescens cairnsi Coues

Dendroica caerulescens cairnsi Coues, Auk, **14**, 1897, p. 96.

Type.— No. 247,562, ♂; North Carolina, Buncombe Co.; 1 June, 1895; John S. Cairns.

Dendroica nigrifrons Brewster

now Dendroica auduboni nigrifrons Brewster

Dendroica nigrifrons Brewster, Auk, **6**, 1889 (April), p. 94; separates issued in advance, January 31, 1889.

Cotype.— No. 214,381, ♂; Chihuahua, Pinos Altos; 5 June, 1888; M. A. Frazar.

Cotype.— No. 214,382, ♀; Chihuahua, Pinos Altos; 5 June, 1888; M. A. Frazar.

Cotype.— No. 214,383, ♂, juvenile; Chihuahua, Pinos Altos; 13 July, 1888; M. A. Frazar.

Dendroica virens waynei Bangs

Dendroica virens waynei Bangs, Proc. New Eng. Zoöl. Club, **6**, 1918, p. 93.

Type.— No. 81,495, ♂; South Carolina, Mount Pleasant; 25 April, 1918; A. T. Wayne.

Pinacantor vigorsii florida Maynard

now Dendroica pinus florida (Maynard)

Pinacantor vigorsii florida Maynard, Directory to the Birds of Eastern North America, 1907, p. 244.

Cotype.— No. 60,911, ♂; Florida, Deep Creek; 19 March, 1901; C. J. Maynard.

Cotype.— No. 60,912, ♀; Florida, Enterprise; 5 March, 1901; C. J. Maynard.

Dendroica bahamensis Maynard

now Dendroica pinus achrustera Bangs

Dendroica bahamensis Maynard, Appendix to Cat. Birds West Indies, Nov. 29, 1899, p. 33, issued as a separate leaflet; (not *Dendroica pityophila bahamensis* Cory, Auk, **8**, 1891, p. 348).

Dendroica achrustera Bangs, Auk, **17**, 1900, p. 292; new name to replace *Dendroica bahamensis* Maynard, preoccupied.

Cotype.— No. 103,351, ♂; New Providence Island, Nassau; 6 March 1897; C. J. Maynard.

Cotype.— No. 103,352, ♀; New Providence Island, Nassau; 6 March, 1897; C. J. Maynard.

Dendroica vitellina nelsoni Bangs

Dendroica vitellina nelsoni Bangs, Bull. Mus. Comp. Zoöl., **62**, 1919, p. 494.

Type.— No. 58,207, ♀; Swan Island, off Honduras; 3 December 1912; George Nelson.

Sylvia tolmiei J. K. Townsend

now Oporornis tolmiei (Townsend)

Sylvia tolmiei Townsend, Narrative, April, 1839, p. 343.

Cotype.— No. 35,008, ♂; Columbia River; 31 May, 1835; J. K. Townsend.

Our specimen bears two labels, one giving the full data, another written by Greene Smith in whose collection it was and from whom we received it, which reads — "This specimen belonged to J. J. Audubon. I got it from John G. Bell."

As this is one of the original specimens collected by Townsend, it must be given the same standing as all others that are still extant. Ridgway claims the "type" in the United States National Museum, but that specimen and ours are both cotypes. From the same specimens collected by Townsend, Audubon later described his *Sylvia macgillivrayi* (Orn. Biog. **5**, 1839, p. 75, pl. 399, figs. 4 and 5).

Geothlypis trichas ignota Chapman

Geothlypis trichas ignota Chapman, Auk, **7**, 1890, p. 11.

Cotype.— No. 228,026, ♂; Florida, Tarpon Springs; 19 May, 1887; W. E. D. Scott.

Cotype.— No. 228,027, ♀; Florida, Tarpon Springs; 27 May, 1887; W. E. D. Scott.

Geothlypis trichas occidentalis Brewster

Geothlypis trichas occidentalis Brewster, Bull. Nutt. Orn. Club, **8**, 1883, p. 159.

Type.— No. 205,550, ♂; Nevada, Truckee River; 4 May, 1881.

Geothlypis rostratus Bryant

Geothlypis rostratus Bryant, Proc. Bost. Soc. N. H., **11**, 1867, p. 67.

Cotype.— No. 73,316, ♂; Bahamas, New Providence Island; H. Bryant.

Bryant mentioned collecting three specimens, all males. One cotype is in the United States National Museum. I do not know where the third specimen is.

Geothlypis maynardi Bangs

Geothlypis maynardi Bangs, Auk, **17**, 1900, p. 290.

Type.— No. 103,363; Bahamas, New Providence Island, Nassau; 11 May, 1897; C. J. Maynard.

I have never felt that Todd (Auk, **28**, 1911, pp. 237–253) proved his case in his attempt to unite *rostrata* and *maynardi*, and I, therefore, retain *maynardi*. Our very good series certainly shows differences that appear greater than those due to age or to individual variation. Todd also did not disprove Maynard's contention that the birds in life can always be told apart by the great differences in their respective songs. In his attempt to discredit *maynardi* Todd brought forward a conspicuous fallacy — assuming that there cannot be two species closely alike in one small island. This we all know happens in nature again and again, not only in birds but in all groups of animals. Furthermore Todd suggests that the difference in size that exists between the two forms is probably due to *maynardi* being an older or more fully adult stage. I know of no case of a passerine bird continuing to grow after its first moult into the adult dress!

Muscicapa pusilla Wilson

now Wilsonia pusilla pusilla (Wilson)

Muscicapa pusilla Wilson, Am. Orn., **3**, 1811, p. 103, pl. 26, fig. 4.

Type.— No. 67,869; from the old Peale Museum.

† Setophaga nigrocincta Lafresnaye

= Wilsonia canadensis (Linné)

Setophaga nigro-cincta Lafresnaye, Rev. Zoöl., 1843, p. 292.

Type.— No. 76,838; Lafresnaye Collection, no. 4,109; Colombia.

Muscicapa canadensis Linné, Syst. Nat., **1**, 1766, p. 327.

Soon after Lafresnaye described his *nigro-cincta*, he detected his mistake, and wrote a second label for the type specimens, so stating, and with full and correct synonymy.

Myioborus aurantiacus acceptus Bangs

Myioborus aurantiacus acceptus Bangs, Proc. New Eng. Zoöl. Club, **4**, 1908, p. 30.

Type.— No. 109,564, ♀; Panama, Boquete; 17 January, 1901; W.W. Brown.

Setophaga ornata Boissonneau

now Myioborus ornatus (Boissonneau)

Setophaga ornata Boissonneau, Rev. Zoöl., 1840, p. 70.

Type.— No. 76,106; Lafresnaye Collection, no. 4,137; Santa Fé de Bogotá.

This specimen is the type of one of the twelve species described by Boissonneau in the Revue Zoölogique, 1840, pp. 66–71. Lafresnaye bought the lot and the types of ten of the species are still in the collection, those of the other two have disappeared.

† Setophaga flaveola Lafresnaye

= Myioborus ornatus (Boissonneau)

Setophaga flaveola Lafresnaye, Rev. Zoöl., 1844, p. 81.

Type.— No. 76,107; Lafresnaye Collection, no. 4,140; Bogotá.

Setophaga ornata Boissonneau, Rev. Zoöl., 1840, p. 70.

The type of *flaveola* as suggested by Salvin (Ibis, 1878, p. 315) represents the immature plumage of *M. ornata*.

Setophaga brunneiceps Lafresnaye and d'Orbigny

now Myioborus brunneiceps (Lafresnaye and d'Orbigny)

Setophaga brunneiceps Lafresnaye and d'Orbigny, Mag. Zoöl., 1837, p. 50.

Cotype.— No. 76,265; Lafresnaye Collection, no. 4,133; Bolivia, Yungas; d'Orbigny.

Dr. Hellmayr considers this specimen to be a cotype. There is one other cotype in the Paris Museum.

Trichas nigrocristatus Lafresnaye

now Myiothlypis nigrocristatus (Lafresnaye)

Trichas nigro-cristatus Lafresnaye, Rev. Zoöl., 1840, p. 230.

Type.— No. 76,266; Lafresnaye Collection, no. 4,116; Bogotá.

Lafresnaye's label for this specimen, reads — "Trichas nigro-cristatus nob. rev. 1840, p. 230, Bogotá."

Three more examples were listed by Verreaux as "types" nos. 4,117, 4,118 and 4,119. None of these have labels that in any way suggest that they are cotypes, and No. 4,119 is not this species at all, but *Basileuterus luteoviridis* (Bonaparte).

Basileuterus melanotis daedalus Bangs

now Basileuterus tristriatus daedalus Bangs

Basilenterus melanotis daedalus Bangs, Proc. Biol. Soc. Washington, **21**, 1908, p. 160.

Type.— No. 120,709, ♂; western Colombia, San Antonio, Rio Cali; 27 December, 1907; M. G. Palmer.

† Sylvia miniata Lafresnaye

= Ergaticus ruber (Swainson)

Sylvia miniata Lafresnaye Mag. Zoöl., 1836, Class II, pl. 54, text and plate (not *Setophaga miniata* Swainson).

Type.— No. 84,282; Lafresnaye Collection, no. 4,144; Mexico.

Setophaga rubra Swainson, Philos. Mag., new series, **1**, 1827, p. 368.

Lafresnaye tells us that his type was got by Sallé — "Il a été trouvé en août à Las Vegas, près Jalapa." Some time later Lafresnaye secured a second specimen, No. 4,143, that he identified correctly as *Setophaga rubra* Swainson.

DREPANIDIDAE

Certhia pacifica Gmelin

now Drepanis pacifica (Gmelin)

Certhia pacifica Gmelin, Syst. Nat., **1**, 1788, p. 470.

Cotype.— No. 236,875.

Our specimen is one of the two cotypes that were for years in the Vienna Museum. It was secured from that institution by Doctor Leonard C. Sanford, and came to us in exchange from him for one of our pair of *Ciridops* — the unique female.

The two cotypes of *Drepanis pacifica* were bought from the Leverian Museum by Fichtel, and at his death passed into the possession of the Vienna Museum. I am told both specimens were collected by Captain Cook, and ours at least was dried and not skinned (see Rothschild, Birds of Laysan, p. 240).

In his Extinct Birds, Rothschild gives an account of the two cotypes of *Drepanis pacifica*, one of which has now found its way into the Museum of Comparative Zoölogy.

Vestiaria coccinea suavis Bangs

Vestiaria coccinea suavis Bangs, Proc. Biol. Soc. Washington, **24**, 1911, p. 29.

Type.— No. 115,059, ♂; Molokai Island; 5 February, 1895; M. G. Flood.

† Mellithreptus olivaceus Lafresnaye

= Heterorhynchus lucidus (Lichtenstein)

Mellithreptus olivaceus Lafresnaye, Rev. Zoöl., 1839, p. 293.

Heterorhynchus olivaceus Lafresnaye Rev. Zoöl., 1839, p. 293, footnote; Mag. Zoöl., 1839, pl. 10; Rev. Zoöl., 1840, p. 221.

Type.— No. 75,289; Lafresnaye Collection, no. 5,677 bis; Sandwich Islands.

Hemignathus lucidus Lichtenstein, Abh. K. Akad. Berlin, 1839, p. 451, tab. and fig. 2.

Lafresnaye wrote four labels for his specimen, which are as follows —

First Label — "Gre Mellithreptus heorotaire S. G. heterorhynchus olivaceus nob. mag. Mellithreptus olivaceus nob. rev. zoöl., 1839–10. (îles Sanwich) il doit être plus grimpeur que l'heor. Vest. d'après son pouce et la force de ses doigts."

Second Label — "Vestiaria (Fleming) heterorhynchus less. rev. zoöl. 1840, p. 269. heterorhynchus olivaceus, heterochytus, nob."

Third Label — "hemignathus, Licht. 1838 heterorhynchus nob. 1839 selon gray. hemig. lucidus Licht. Gray 16."

Fourth Label — "hemignathe olivatre Licht. hemignathus olivaceus zoöl. de la Venus, ois, pl. 1, 5."

Lafresnaye's type is now in fairly good condition. Some years ago, while still mounted, it was sent for comparison to Professor Newton at his request. The two trips across the Atlantic and probably a good deal of handling resulted in the loss of some of its feathers. It is now made into a skin, and with care should last indefinitely. It is, of course, an interesting historical specimen of a now extinct species, of which very few examples exist in Museums.

Lafresnaye bought the bird for 25 francs from DuPont, to whom Lechlancher had sold some skins collected during the course of the voyage of the Venus. From this same source Bourcier procured his type of Costa's humming bird, *Calypte costae* (Bourcier).

Lafresnaye also had in his cabinet two specimens of *Chlorodrepanis chloris* Cabanis, Nos. 5,683 and 5,684, which were collected during the course of the voyage of the Venus. These specimens much puzzled Lafresnaye, who, after suggesting several names on the labels, finally called them, with a query, the young of his *Heterorhynchus olivaceus*.

There is also in the collection a fine adult male of the now extinct *Loxops rufa* (Blosam) of Oahu. Lafresnaye wrote no label for this specimen, and its history is, therefore, lost, but doubtless it was from the same source as his other *Drepanididae*. So far as we have been able to tell, the specimen was not listed by Verreaux in his catalogue; it is, however, a Lafresnaye bird, mounted on the same style of stand, and put up as are the characteristic French mounts of the period.

Psittacirostra psittacea oppidana Bangs

Psittacirostra psittacea oppidana Bangs, Proc. Biol. Soc. Washington, **24**, 1911, p. 30.

Type.— No. 115,047, ♂; Molokai Island; 8 February, 1895; M. J. Flood.

Hartert (Nov. Zoöl., **26**, 1919, p. 170) says "*Psittirostra oppidana* Bangs, Molokai, is *not* separable from *P. p. psittacea*." So far as our material, which is pretty good, goes, this is not true. All our Molokai birds are easily told from all in a long series from Hawaii.

MOTACILLIDAE

Budytes flavus plexus Thayer and Bangs

Budytes flavus plexus Thayer and Bangs, Proc. New Eng. Zoöl. Club, **5**, 1914, p. 41.

Type.— No. 64,033, ♂; Siberia, Kolyma, Nijni Kolymsk; 2 June, 1912; J. Koren.

Hartert looked upon this form with disfavor. Sushkin, however, on the basis of eighteen specimens, recognizes it in his review of the Asiatic forms of *B. flavus* (Proc. Bost. Soc. N. H., **38**, 1925, p. 31).

Anthus phillipsi W. S. Brooks

Anthus phillipsi Brooks, Proc. New Eng. Zoöl. Club, **6**, 1916, p. 26.

Type.— No. 70,370, ♂; Falkland Islands, Port Stanley; 30 October, 1915; W. S. Brooks.

ALAUDIDAE

Alauda albofasciata Lafresnaye

now Certhilauda albofasciata albofasciata (Lafresnaye)

Alauda albofasciata Lafresnaye, Mag. Zoöl., 1836, Cl. II, pl. 58, text.
Certhilauda albofasciata Lafresnaye, Mag. Zoöl., 1836, Cl. II, pl. 58, plate.

Type.— No. 83,866; Lafresnaye Collection, no. 3,292; Cape of Good Hope; M. M. Verreaux fils.

There is one other specimen in the Lafresnaye Collection, M. C. Z., no. 83,865, Lafresnaye Collection, no. 3,294, which is the individual mentioned by Lafresnaye as having less black in the central portions of the feathers of the upper parts, and with brighter under parts. The original description, however, as well as the plate, were made from the specimen we list here as the type.

† Alauda rufopalliata Lafresnaye

= Certhilauda semitorquata A. Smith

Alauda rufo-palliata Lafresnaye, Mag. Zoöl., 1836, pl. 59, text.
Certhilauda rufo-palliata Lafresnaye, Mag. Zoöl., 1836, Cl. 2, pl. 59, plate.

Type.— No. 83,867; Lafresnaye Collection, no. 3,292; "Af. mérid. Verreaux."

Certhilauda semitorquata A. Smith, Rep. Exp., 1836, p. 47; Ills. S. Afr., 1846, pl. 106.

Lafresnaye and Smith, both described this species in the same year, 1836; Smith's name, however, appeared first.

† Alauda cornuta Wilson

= Eremophila alpestris alpestris (Linné)

Alauda cornuta Wilson, Am. Orn., **1**, 1808, p. 87.

Type.— No. 67,856; from the old Peale Museum.

Alauda alpestris Linné, Syst. Nat., ed. 10, **1**, 1758, p. 166.

† Otocoris alpestris euroa Thayer and Bangs

= Eremophila alpestris flava (Gmelin)

Otocoris alpestris euroa Thayer and Bangs, Proc. New Eng. Zoöl. Club, **5**, 1914, p. 43.

Type.— No. 64,038, ♂; Siberia, Kolyma, Nijni Kolymsk; 14 May, 1912; J. Koren.

Alauda flava Gmelin, Syst. Nat., **1**, 1788, p. 800.

Jordans (Journ. f. Orn., **73**, 1925, pp. 446–452) has reduced our *euroa* to the synonymy of *flava*. We have here a fair series of European birds and also a number of skins of migrants from northern China. All I can say is that among all these there are none so pale as the Kolyma individuals.

Otocoris alpestris merrilli Dwight

now Eremophila alpestris merrilli (Dwight)

Otocoris alpestris merrilli Dwight, Auk, **7**, 1890, p. 153.

Cotype.— No. 219,516, ♂ ad.; Oregon, Fort Klamath; 1 July, 1887; J. C. Merrill.

Cotype.— No. 219,538, ♀ ad.; Oregon, Fort Klamath; 23 May, 1887; J. C. Merrill.

Cotype.— No. 218,857, ♂; Oregon, Fort Klamath; 13 September, 1887; S. Parker.

Cotype.— No. 218,882, ♀; Oregon, Fort Klamath; 26 October, 1887; S. Parker.

Cotype.— No. 219,524, ♂, juvenile; Oregon, Fort Klamath; 1 July, 1887; J. C. Merrill.

I suppose Dwight made this long array of cotypes in the Brewster Collection to cover all the different plumages — summer, autumn, and juvenile.

Otocoris alpestris adusta Dwight

now Eremophila alpestris adusta (Dwight)

Otocoris alpestris adusta Dwight, Auk, **7**, 1890, p. 148.

Cotype.— No. 223,575, ♂; Arizona, Camp Huachuca; 21 February, 1887; J. C. Cahoon.

Cotype.— No. 223,588, ♀; Arizona, Camp Huachuca; 2 March, 1887; J. C. Cahoon.

Cotype.— No. 223,555, ♂; Chihuahua, Chihuahua; 28 September, 1888; M. A. Frazar.

Alauda gulgula pescadoresi La Touche

Alauda gulgula pescadoresi La Touche, Bull. B. O. C., **43**, 1922, p. 20.

Type.— No. 126,210; Pescadores Islands; 10 February, 1894.

† Alauda albescens Lafresnaye

= Mirafra nivosa (Swainson)

Apaluda albescens Lafresnaye, Rev. Zoöl., 1839, p. 259.

Type.— No. 76,247; Lafresnaye Collection, no. 3,261; "Africa australi."

Certhilauda nivosa Swainson, W. Af., **1**, 1837, p. 213.

Lafresnaye's type is an adult bird in the gray winter plumage.

† Alauda guttata Lafresnaye

= Mirafra nivosa (Swainson)

Alauda guttata Lafresnaye, Rev. Zoöl., 1839, p. 259.

Type.— No. 76,248; Lafresnaye Collection, no. 3,260; "Africa australi."

Certhilauda nivosa Swainson, W. Af., **1**, 1837, p. 213.

The type of Lafresnaye's *guttata* is an immature bird, very reddish brown above with whitish tips to the feathers, giving the upper parts a spotted appearance.

Galerida cristata retrusa Bangs and Peters

Galerida cristata retrusa Bangs and Peters, Bull. Mus. Comp. Zoöl., **68**, 1928, p. 370.

Type.— No. 238,709, ♂; western Kansu, Kanchow plain, foot of the northern Kanchow Nanshan; November, 1925; Joseph F. Rock.

Alauda ferruginea Lafresnaye

now Ammomanes burra nom. nov.

Alauda ferruginea Lafresnaye, Rev. Zoöl., 1839, p. 258 (not *Alauda ferruginea* F. S. Voigt, in Cuvier, Thierreich, **1**, 1831, p. 551).

Alauda ferruginea Smith, Ills. Zoöl., S. Afr., Aves, 1839, pl. 29 (not *Alauda ferruginea* Voigt).

Type.— No. 76,171; Lafresnaye Collection, No. 3,254; 'Africa australi."

Smith and Lafresnaye used the same name for this species, when they simultaneously described it as new. It really makes no difference which name actually appeared first, as both are preoccupied by *ferruginea* of Voigt, given to a different species. As I find no other name that applies to the present species I have had to rename it as above.

CATAMBLYRHYNCHIDAE

Catamblyrhynchus diadema Lafresnaye

Catamblyrhynchus diadema diadema Lafresnaye, Rev. Zoöl., 1842, p. 301; Mag. Zoöl., 1843, pl. 34.

Type.— No. 76,262; Lafresnaye Collection, no. 6,804; "Colombie, Bogotá."

There are two more specimens in the Lafresnaye Collection, one with a label which makes it plain that it was received at a later date than was the type; the other an immature bird.

FRINGILLIDAE

Eophona migratoria harterti La Touche

Eophona migratoria harterti La Touche, Bull. B. O. C., **43**, 1923, p. 150.

Cotype.— No. 125,832, ♂; Yunnan, Milati; 9 January, 1921.

Cotype.— No. 125,833, ♀; Yunnan, Milati; 10 February, 1921.

I wholly agree with Rothschild (Nov. Zoöl., **33**, 1926, p. 334) that this is a form which may prove to be too close to true *migratoria*, but for the present I follow him and recognize it.

Hesperiphona abeillei pallida Nelson

Hesperiphona abeillei pallida Nelson, Proc. Biol. Soc. Washington, **41**, 1928, p. 155.

Type.— No. 222,053, ♀; Chihuahua, Jesus Maria; June, 1883; R. R. McLeod.

† Coccothraustes fortirostris Lafresnaye

= Mycerobas melanoxanthus Hodgson

Coccothraustes fortirostris Lafresnaye, Rev. Zoöl., 1840, p. 228.

Type.— No. 77,042; Lafresnaye Collection, no. 6,682; "Hymalayenses montes."

Mycerobas melanoxanthus Hodgson, Icon, Ined. in Brit. Mus., Passeres; As. Res. 1836, **19**, p. 150.

Lafresnaye's type is an adult female. He bought it of Boissonneau.

Pitylus aureoventris d'Orbigny and Lafresnaye

now Pheucticus aureoventris (d'Orbigny and Lafresnaye)

Pitylus aureo-ventris d'Orbigny and Lafresnaye, Mag. de Zoöl., 1837, p. 84.

Cotype.— No. 76,580; Lafresnaye Collection, no. 6,670, ♂; Bolivia, Yungas, Sicasica; d'Orbigny.

Dr. Hellmayr tells me that there are two other cotypes in the Paris Museum, one ♂, Sicasica and one ♀, just labelled Bolivia.

† Loxia rosea Wilson

= Hedymeles ludoviciana (Linné)

Loxia rosea Wilson, Am. Orn., **2**, 1810, p. 135, pl. 17, fig. 2.

Type.— No. 67,864 [♂]; from the old Peale Museum.

Loxia ludoviciana Linné, Syst. Nat. ed. 12, **1**, 1766, p. 306.

† Cyanocompsa concreta sanctae-martae Bangs

= Cyanocompsa cyanoides cyanoides (Lafresnaye)

Cyanocompsa concreta sanctae-martae Bangs, Proc. Biol. Soc. Washington, **12**, 1898, p. 139.

Type.— No. 105,361, ♂; Colombia, Santa Marta; 2 February, 1898; W. W. Brown.

Coccobirus cyanoides Lafresnaye, Rev. Zoöl., 1847, p. 74.

Cyanocompsa parellina beneplacita Bangs

Cyanocompsa parellina beneplacita Bangs, Proc. Biol. Soc. Washington, **28**, 1915, p. 126.

Type.— No. 49,685, ♂; Mexico, Tamaulipas, Santa Leonor; 5 April, 1909; F. B. Armstrong.

Pyrrhula glauco-caerulea d'Orbigny and Lafresnaye

now Cyanoloxia glauco-caerulea (d'Orbigny and Lafresnaye)

Pyrrhula glauco-caerulea d'Orbigny and Lafresnaye, Mag. Zoöl., 1837, p. 85.

Cotype.— No. 76,649, ♂; Lafresnaye Collection, no. 6,655; "Maldonedo, rep. orient."; d'Orbigny.

There is one other cotype, an adult male in the Paris Museum.

Loxigilla noctis sclateri Allen

now Pyrrhulagra noctis sclateri (Allen)

Loxigilla noctis selateri Allen, Bull. Nutt. Orn. Club, **5**, 1880, p. 166.

Cotypes.— No. 26,693; 27,365–67; 28,627–29; West Indies, Saint Lucia; John Semper.

J. A. Allen based this form on eight males received from Semper from Saint Lucia. One of the cotypes, No. 26,692, was exchanged to C. B. Cory, and is now in the Field Museum of Natural History at Chicago.

Coccothraustes cinerea Lafresnaye

now Piezorhina cinerea (Lafresnaye)

Coccothraustes cinerea Lafresnaye, Mag. Zoöl., 1843, Ois., pl. 30, text.
Guiraca cinerea Lafresnaye, Mag. Zoöl., 1843, Ois., pl. 30, plate.

Type.— No. 76,626; Lafresnaye Collection, no. 6,845.

The type was collected by Leclancher on the voyage of the Venus, and was said to have come from the Galapagos. The species is common in the arid coastal regions of northwest Peru, whence without much doubt the type actually came.

† Tiaris olivacea dissita Thayer and Bangs

= Tiaris olivacea pusilla Swainson

Tiaris olivacea dissita Thayer and Bangs, Bull. Mus. Comp. Zoöl., **46**, 1906, p. 223.

Type.— No. 114,212, ♂; Panama, near Panama City; 14 May, 1904; W. W. Brown.

Tiaris pusilla Swainson, Philos. Mag., new series, **1**, 1827, p. 438.

I have long since given up this supposed Panama race, which proves to have been based on individual peculiarities.

Tiaris bicolor expectata Noble

Tiaris bicolor expectata Noble, Bull. Mus. Comp. Zoöl., **60**, 1916, p. 385.

Type.— No. 113,109, ♂; Lesser Antilles, Grenada; 19 June, 1904; Austin H. Clark.

Sporophila schistacea arthuri Penard

Sporophila schistacea arthuri Penard, Proc. Biol. Soc. Washington, **36**, 1923, p. 59.

Type.— No. 89,377, ♀; Surinam, Lelydorp; 19 October, 1921.

Sporophila minuta centralis Bangs and Penard

Sporophila minuta centralis Bangs and Penard, Bull. Mus. Comp. Zoöl., **62**, 1918, p. 90.

Type.— No. 40,784, ♂; Panama, near Panama; 19 May, 1904; W. W. Brown.

Spermophila palustris Barrows

now Sporophila palustris (Barrows)

Spermophila palustris Barrows, Bull. Nutt. Orn. Club, **8**, 1881, p. 72.

Cotype.— No. 31,309, ♂; Argentina, Entre Rios, Concepcion del Uruguay; 7 December, 1880; W. B. Barrows.

Cotype.— No. 31,597, ♂; Argentina, Entre Rios, Concepcion del Uruguay; 7 December, 1880; W. B. Barrows.

Two other cotypes are in the British Museum. These were figured by Sharpe, Cat. of Birds British Mus., **12**, 1888, plate 2.

† Spermophila olivaceoflava Lafresnaye

= Sporophila crispa crispa (Linné)

Spermophila olivaceo-flava Lafresnaye, Rev. Zoöl., 1843, p. 291.

Type.— No. 77,372; Lafresnaye Collection, no. 6,628; Colombia.

Fringilla crispa Linné, Syst. Nat., ed. 12, 1766, p. 324.

The type of Lafresnaye's *S. olivaceoflava* is not a young bird, but an adult in the so-called "seasonal plumage" described by Sharpe (British Mus. Cat., **12**, 1888, p. 128). It may be briefly described as follows:— upper parts, including crown and sides of head, dull olive; throat, chest and sides dark brownish olive; a blackish band separating the colors of chest and breast; breast and belly dull yellow; no white alar spot. In our extensive series of *S. crispa* which includes adults in both fresh and abraded plumage and young of various ages, we have none like Lafresnaye's type and it is hard to believe that the plumage described is of seasonal character. Do not the birds like it represent a distinct species? If so Lafresnaye's name is available.

In my opinion *Fringilla crispa* Linné, based upon the Black and Yellow Frizzled Sparrow of Edwards, 1760, part 2, p. 128, pl. 271, is the proper name for the species currently called *Sporophila gutturalis* (*Fringilla gutturalis* Lichtenstein, Verz. Doubl., 1823, p. 26, Sao Paulo). Edwards's plate agrees exactly in measurements and color with this species except that the yellow is a little too vivid. It was drawn from a living bird in possession of Mrs. Clayton. The frizzled appearance of the feathers is simply due to the fact that the individual was in confinement. Buffon's plate 319 of the Bouvreuil, *Sporophila lineola*, also shows the curved feathers, evidently also the result of captivity.

Spermophila luctuosa Lafresnaye

now Sporophila luctuosa (Lafresnaye)

Spermophila Sw. *luctuosa* Lafresnaye, Rev. Zoöl., 1843, p. 291.

Cotype.— No. 76,629, ♂; Lafresnaye Collection, no. 6,629; Colombia.

Cotype.— No. 76,630, ♂; Lafresnaye Collection, no. 6,630; Colombia.

The two specimens are exactly alike, and as Lafresnaye wrote precisely similar labels for both, both are cotypes.

Fringilla analis Lafresnaye

now Idiospiza analis analis (Lafresnaye)

Fringilla analis Lafresnaye, Rev. Zoöl., 1843, p. 291.

Type.— No. 76,646; Lafresnaye Collection, no. 6,577; "Colombie; nlle. Grenade."

Fringilla analis has usually been considered a synonym of *Catamenia analoides* (Lafresnaye), but the type, which is a female and which came from Colombia, is without white in the tail and proves on comparison to belong to the form that was long afterwards named *Catamenia inornata minor* by Berlepsch (P. Z. S., 1885, p. 115).

I wholly agree with Todd and with Chapman that *Idiospiza* and *Catamenia* must be maintained as distinct genera, and as Lafresnaye's species belongs to the former, his name is no longer preoccupied by *Linaria* (=*Catamenia*) *analis* d'Orbigny and Lafresnaye (1837). The Bolivian form of the species now becomes *Idiospiza analis inornata* (Lafresnaye).

Linaria analis d'Orbigny and Lafresnaye

now Catamenia analis analis (d'Orbigny and Lafresnaye)

Linaria analis d'Orbigny and Lafresnaye, Mag. Zoöl., 1837, p. 83.

Cotype.— No. 76,647, ♂; Lafresnaye Collection, no. 6,575; "Sica sica, cochabamba"; d'Orbigny.

Cotype.— No. 76,648, ♀; Lafresnaye Collection, no. 6,576; "Bolivie"; d'Orbigny.

In the Paris Museum are also two cotypes, ♂, Bolivia and ♀, Cochabamba.

Catamenia alpica Bangs

Catamenia alpica Bangs, Proc. New Eng. Zoöl. Club, **3**, 1902, p. 89.

Type.— No. 106,248, ♀; Colombia, Santa Marta Mountains, Paramo de Chiruqua, 15,000 feet altitude; 27 February, 1899; W. W. Brown.

† Cardinalis bermudianus Bangs and Bradlee

= Richmondena cardinalis cardinalis (Linné)

Cardinalis bermudianus Bangs and Bradlee, Auk, **18**, 1901, p. 256.

Type.— No. 39,132, ♂; Bermuda, Hamilton; 8 March, 1901; T. S. Bradlee.

Loxia cardinalis Linné, Syst. Nat., ed. 10, **1**, 1758, p. 172.

Mr. A. H. Verrill also named the Bermuda Cardinal, his description and Bradlee's and mine appearing simultaneously. I now wholly agree with Ridgway that the race cannot be maintained, and it, therefore, matters not whose name actually appeared first.

Cardinalis cardinalis magnirostris Bangs

now Richmondena cardinalis magnirostris (Bangs)

Cardinalis cardinalis magnirostris Bangs, Proc. New Eng. Zoöl. Club, **4**, 1903, p. 5.

Type.— No. 110,834, ♂; Louisiana, Baton Rouge Parish; 26 January, 1903; F. H. Carruth, Jr.

Cardinalis cardinalis flammiger Peters

now Richmondena cardinalis flammiger (Peters)

Cardinalis cardinalis flammiger Peters, Auk, **30**, 1913, p. 380.

Type.— No. 60,629, ♂; Mexico, Quintana Roo, Xcopen; 8 March 1912; J. L. Peters.

† Pitylus atropurpuratus Lafresnaye

= Rhodothraupis celaeno (Lichtenstein) adult male.

Pitylus atro-purpuratus Lafresnaye, Rev. Zoöl., 1838, p. 224.

Type.— No. 76,576 [adult ♂]; Lafresnaye Collection, no. 3,223; Mexico.

Tanagra celaeno Lichtenstein, Preis-Verz. Mex., Vög., 1831, p. 2.

Lafresnaye had another adult ♂ in his cabinet, no. 3,224, but this is not a cotype, as Lafresnaye wrote a wholly differently worded label for it. He also had an immature example that he thought came from California and represented a new species, for which he wrote a label that reads — "Californie, Leinier, nov. species?"

† Pitylus atroolivaceus Lafresnaye

= Rhodothraupis celaeno (Lichtenstein) adult female

Pitylus atro-olivaceus Lafresnaye Rev. Zoöl., 1838, p. 224.

Type.— No. 76,578 [adult ♀]; Lafresnaye Collection, no. 3,225; Mexico.

Tanagra celaeno Lichtenstein, Preis-Verz. Mex., Vög., 1831, p. 2.

Lafresnaye described the male and female of this species thinking them to represent two distinct species.

Pyrrhula raptor Cabot

now Saltator atriceps raptor (Cabot)

Pyrrhula raptor Cabot, Boston Jour. of N. H., **5**, 1844, p. 90, pl. 12.

Cotype.— No. 72,574, ♂; Yucatan; S. Cabot.

Cotype.— No. 76,958, ♂; Yucatan; S. Cabot.

The latter cotype turned up unexpectedly with some other Cabot birds, that had been taken off exhibition and found packed away in a box, after I had published a list of the Cabot types (Auk, **31**, 1915, p. 169). Besides these male cotypes, there are three Cabot specimens of *Saltator grandis yucatanensis* Berlepsch, which Cabot thought were females of his *raptor*. These are Nos. 72,520, 76,959, and 76,960. The last two were in the box with the extra male cotype.

Saltator lacertosus Bangs

now Saltator atriceps lacertosus Bangs

Saltator lacertosus Bangs, Proc. New Eng. Zoöl. Club, **2**, 1900, p. 31.

Type.— No. 107,524, ♀; Panama, Loma del Leon; 10 March, 1900; W. W. Brown.

Saltator magnoides Lafresnaye

now Saltator maximus magnoides Lafresnaye

Saltator magnoides Lafresnaye, Rev. Zoöl., 1844, p. 41.

Type.— No. 76,563; Lafresnaye Collection, no. 3,186; "Mexique;" error, = Guatemala.

The type is in excellent condition and agrees minutely with Lafresnaye's description. Another specimen, No. 3,185, belongs to the same subspecies but judged by the written label was acquired by Lafresnaye at a later date and is not a cotype, while the third specimen listed by Verreaux as a "type," No. 3,184 is without a label and belongs to another subspecies — the Mexican *Saltator maximus gigantodes* Cabanis. (Cf. Peters, Bull. Mus. Comp. Zoöl., **69**, 1929, p. 467 for change in the names of the Mexican and Central American races).

Saltator maximus iungens Griscom

Saltator maximus iungens Griscom, Bull. Mus. Comp. Zoöl., **69**, 1929, p. 184.

Type.— No. 140,509, ♂; Eastern Panama, Cana; 5 April, 1928; Rex R. Benson.

Saltator similis d'Orbigny and Lafresnaye

Saltator similis d'Orbigny and Lafresnaye, Mag. Zoöl., 1837, p. 36.

Cotype.— No. 76,574; Lafresnaye Collection, no. 3,197; "Corrientes, Argentina"; d'Orbigny.

One cotype is in the Paris Museum.

† Saltator icterophrys Lafresnaye

= Saltator grandis (Lichtenstein)

Saltator icterophrys Lafresnaye, Rev. Zoöl., 1844, p. 41.

Type.— No. 76,613; Lafresnaye Collection, no. 3,196; Mexico.

Tanagra grandis Lichtenstein, Preis-Verz. Mex., Vög., 1831, p. 2.

Lafresnaye's type is a young bird in the greenish plumage with yellowish throat and superciliaries.

Saltator olivascens brewsteri Bangs and Penard

Saltator olivascens brewsteri Bangs and Penard, Bull. Mus. Comp. Zoöl., **62**, 1918, p. 91.

Type.— No. 230,845, ♂; Trinidad, Caparo; 22 March, 1894; Wm. Brewster.

Saltator orenocensis Lafresnaye

now Saltator orenocensis orenocensis Lafresnaye

Saltator orenocensis Lafresnaye, Rev. Zoöl., 1846, p. 274.

Cotype.— No. 76,571; Lafresnaye Collection, no. 3,190; "Côte ferme, Embouches de l'orenoque."

Cotype.— No. 76,572; Lafresnaye Collection,no. 3,191; "Côte ferme, Embouches de l'orenoque."

For his two specimens, Lafresnaye wrote labels exactly alike.

Saltator aurantiirostris nasica Wetmore and Peters

Saltator aurantiirostris nasica Wetmore and Peters, Proc. Biol. Soc. Washington, **35**, 1922, p. 45.

Type.— No. 85,819, ♀; Argentina, Mendoza, Potrerillos; 19 March, 1921; J. L. Peters.

† Saltator gularis Sclater
= Saltator maxillosus Cabanis

Saltator gularis Sclater, P. Z. S., 1856, p. 74, ex Lafr. MS. in museo suo.

Type.— No. 76,573; Lafresnaye Collection, no. 3,198; Brazil.

Saltator maxillosus Cabanis, Mus. Hein., **1**, 1851, p. 142.

Saltator striatipictus Lafresnaye
now Saltator striatipictus striatipictus Lafresnaye

Saltator striatipictus (sic) Lafresnaye, Rev. Zoöl., 1847, p. 73.

Cotype.— No. 76,564; Lafresnaye Collection, no. 3,205; "Nov. gran. Caly" [= Cali, western Colombia.]

Our specimen, No. 76,564, from the type locality, must be considered a cotype of the species, and to this Dr. Stone wholly agrees. The one in Philadelphia listed by Stone (Proc. Acad. Nat. Sci. Phila., 1899, p. 51) is also a cotype.

† Saltator maculipectus Lafresnaye
= Saltator striatipictus striatipictus Lafresnaye

Saltator maculipectus Lafresnaye, Rev. Zoöl., 1847, p. 73.

Type.— No. 76,567; Lafresnaye Collection, no. 3,210; "Nova Grenada."

Saltator striatipictus Lafresnaye, Rev. Zoöl., 1847, p. 73.

There is no doubt but that this bird is the type. It is in much abraded plumage very gray above and very white below, with a conspicuous yellow tip to the bill, thus answering perfectly to Lafresnaye's description. The specimen in Philadelphia listed by Stone as a possible type, I do not consider to be such; and now neither does Stone.

Saltator striatipictus furax Bangs and Penard

Saltator striatipictus furax Bangs and Penard, Bull. Mus. Comp. Zoöl., **63**, 1919, p. 32.

Type.— No. 118,651, ♂; Costa Rica, Lagarto, Boruca; 27 May, 1906; C. F. Underwood.

Saltator striatipictus speratus Bangs and Penard

Saltator striatipictus speratus Bangs and Penard, Bull. Mus. Comp. Zoöl., **63**, 1919, p 33.

Type.— No. 140,501, ♂; Saboga Island, Pearl Islands, Bay of Panama; 6 April, 1904; W. W. Brown.

Saltator guadelupensis Lafresnaye

now Saltator albicollis guadelupensis Lafresnaye

Saltator guadelupensis Lafresnaye, Rev. Zoöl., 1844, p. 167.

Type.— No. 76,568; Lafresnaye Collection, no. 167; Guadeloupe; l'Herminier.

The type, an adult bird, is in fine condition. Two additional specimens, Nos. 3,203 and 3,204, judged by labels written for them by Lafresnaye, are not cotypes.

In my opinion the Guadeloupe bird is easily separable from *Saltator albicollis albicollis* Vieillot, the type locality of which was fixed by Berlepsch as Martinique. Comparing adults only I should arrange our large series of West Indian skins as follows:

1. *Saltator albicollis albicollis* Vieillot, Martinique and St. Lucia. Paler and whiter, less tawny or yellowish below.

2. *Saltator albicollis guadelupeusis* Lafresnaye, Guadeloupe and Dominica.

Darker below and much suffused with tawny or yellowish.

Spinus spinescens capitaneus Bangs

Spinus spinescens capitaneus Bangs, Proc. Biol. Soc. Washington, **12**, 1898, p. 178.

Type.— No. 105,674, ♂; Colombia, Santa Marta Mountains, San Miguel; 14 June, 1898; W. W. Brown.

Carduelis atratus d'Orbigny and Lafresnaye

now Spinus atratus (d'Orbigny and Lafresnaye)

Carduelis atratus d'Orbigny and Lafresnaye, Mag. Zoöl., 1837, p. 83.

Cotype.— No. 76,651, ♂; La Paz, Bolivia; d'Orbigny.

In the Paris Museum there are two more cotypes, an adult male and an immature male.

Carduelis colombianus Lafresnaye

now Spinus psaltria colombianus (Lafresnaye)

Carduelis colombianus Lafresnaye, Rev. Zoöl., 1843, p. 292.

Type.— No. 76,662; Lafresnaye Collection, no. 6,750; "Colombie." [adult ♂].

One other adult male in the collection, no. 6,751 is not a cotype, Lafresnaye himself identifying it as "*Carduelis mexicanus*? Sw." or "*bolivianus*," and finally, apparently long afterwards, writing across the label "*columbinus*" (*sic*).

I do not recognize the genus *Astragalinus* as I cannot distinguish it from *Spinus*.

† Acanthis brewsterii Ridgway

= Hybrid: Acanthis linaria linaria (Linné) × Spinus pinus pinus (Wilson)

Acanthis brewsterii Ridgway, American Naturalist, **6**, 1872 (July), p. 433.

Type.— No. 200,756, ♂; Mass., Waltham; 1 November, 1870; Wm. Brewster.

Leucosticte griseonucha maxima W. S. Brooks

Leucosticte griseonucha maxima W. S. Brooks, Bull. Mus. Comp. Zoöl., **59**, 1915, p. 405.

Type.— No. 66,725, ♂; Copper Island, Commander Islands; 7 May, 1913; J. Dixon.

Leucosticte tephrocotis australis Ridgway

now Leucosticte australis (Ridgway)

Leucosticte tephrocotis var. *australis* Ridgway, Bull. Essex Inst., **5**, 1873, p. 197.

Cotype.— No. 15,724, ♂; Colorado, Mount Lincoln, "above timber line"; 25 July, 1871; Exped. to the Rocky Mountains.

Cotype.— No. 15,721, ♀; Colorado, Mount Lincoln, "above timber line"; 25 July, 1871; Exped. to the Rocky Mountains.

Linaria caniceps d'Orbigny

now Serinus caniceps (d'Orbigny)

Linaria caniceps d'Orbigny in La Sagra, Hist. Nat. Cuba, 1840, (=1839), p. 107, atlas, pl. 16.

Type.— No. 83,869; Lafresnaye Collection, no. 6,785; Cuba (escaped cage bird).

Penard and I (Auk, **37**, 1920, p. 58) have already published an account of this specimen, and use d'Orbigny's name to supplant *Serinus hartlaubi* (Bolle) of West Africa.

Sicalis flaveola valida Bangs and Penard

Sicalis flavcola valida Bangs and Penard, Bull. Mus. Comp. Zoöl., **64**, 1921, p. 396.

Type.— No. 79,766, ♂; Peru, Sullana; 29 July, 1916; G. K. Noble.

Sycalis browni Bangs

now Sicalis citrina browni Bangs

Sycalis browni Bangs, Proc. Biol. Soc. Washington, **12**, 1898, p. 139.

Type.— No. 105,359, ♂; Colombia, Santa Marta; 2 February, 1898; W. W. Brown.

Carpodacus mexicanus potosinus Griscom

now Erythrina mexicana potosina (Griscom)

Carpodacus mexicanus potosinus Griscom, Am. Mus. Novitates, no. 293, 1928, p. 5.

Type.— No. 27,953, ♂; Mexico, San Luis Potosi; 24 March; Edward Palmer.

Carpodacus synoica petrae Phillips

now Erythrina synoica petrae (Phillips)

Carpodacus synoica petrae Phillips, Auk, **32**, 1915, p. 288.

Type.— No. 66,024, ♂; Arabia, Petra; 28 April, 1914; J. C. Phillips.

Pyrrhula griseiventris Lafresnaye

now Pyrrhula pyrrhula griseiventris Lafresnaye

Pyrrhula griseiventris Lafresnaye, Rev. Zoöl., 1841, p. 241.

Type.— No. 76,616; Lafresnaye Collection, no. 6,806.

Lafresnaye's type is a fine adult male with a rosy throat. Apparently judged by his written label, he knew nothing of its origin.

Pyrrhula ricketti La Touche

now Pyrrhula nipalensis ricketti La Touche

Pyrrhula ricketti La Touche, Bull. B. O. C., **16**, 1905, p. 21.

Cotype.— No. 125,858, ♂; N. W. Fohkien, Kuatun; 3 April, 1898; La Touche Collection.

Cotype.— No. 125,859, ♀; N. W. Fohkien, Kuatun; 5 April, 1898; La Touche Collection.

Pinicola enucleator pacata Bangs

Pinicola enucleator pacata Bangs, Bull. Mus. Comp. Zoöl., **54**, 1913, p. 472.

Type.— No. 57,927, ♂; Altai Mountains, Topueho; 9 August, 1912; N. Hollister.

Emberiza fucata fluviatilis La Touche

Emberiza fucata fluviatilis La Touche, Bull. B. O. C., **46**, 1925, p. 23.

Type.— No. 125,341, ♂; eastern China, Chinkiang; 11 May, 1902; La Touche Collection.

Emberiza fucata kuatunensis La Touche

Emberiza fucata kuatunensis La Touche, Bull. B. O. C., **46**, 1925, p. 23.

Cotype.— No. 125,344, ♂; N. W. Fohkien, Kuatun; 23 April, 1898; La Touche Collection.

Cotype.— No. 125,345, ♀; N. W. Fohkien, Kuatun; 13 May, 1897; La Touche Collection.

Emberiza cia styani La Touche

now Emberiza godlewskii styani La Touche

Emberiza cia styani La Touche, Bull. B. O. C., **43**, 1923, p. 81.

Type.— No. 125,662, ♂; N. W. Szechuan, Sungpan; November, 1897.

I think Hartert (Vög. Pal. Fauna, Nachtrag 1, 1923, p. 25) is wrong in placing this name as a synonym of *Emberiza cia omissa* Rothschild. La Touche's type is a bird in full autumnal plumage, and undoubtedly was a migrant. It is larger (wing 85), paler, especially above, and otherwise different from *omissa*. It is not *nanshanica* Sushkin, of which we have a good series, including both summer and winter killed birds, and which is a much paler race. It seems to me to be quite the same as the form later named *Emberiza godlewskii bangsi* by Sushkin, of which I believe it to be a stray migrant.

Sushkin, I think, has made it perfectly clear that *Emberiza cia* and subspecies, must be kept specifically distinct from *Emberiza godlewskii* and subspecies.

† Emberiza godlewskii bangsi Sushkin

= Emberiza godlewskii styani La Touche

Emberiza godlewskii bangsi Sushkin, Proc .Bost. Soc. N. H., **38**, 1925, p. 27.

Type.— No. 87,699, ♂; Shansi, Pashni; 14 September, 1921; F. R. Wulsin.

Emberiza cia styani La Touche, Bull. B. O. C., **43**, 1923, p. 81.

Emberiza cioides fohkienensis La Touche

Emberiza cioides fohkienensis La Touche, Birds of Eastern China, pt. 4, 1927, p. 360.

Type.— No. 125,726, ♂; Fuhkien, Foochow; 1 April, 1896.

Passerculus sandwichensis labradorius Howe

Passerculus sandwichensis labradorius Howe, Contributions to N. Am. Ornith., **1**, 1901, p. 1.

Type.— No. 104,479, ♂; Labrador, Lance au Loup; 17 May, 1899.

In spite of anything that may have been said of it, the large dark Savannah sparrow of Labrador is an excellent race.

† Fringilla passerina Wilson

now Ammodramus savannarum australis (Maynard)

Fringilla passerina Wilson, Am. Orn., **3**, 1811, p. 76, pl. 24, fig. 5 (not *Fringilla passerina* Bechstein, in Latham, Allg. Ueb. Vögel, **3**, 1798, p. 544, pl. 120, fig. 1.)

Type.— No. 67,857; from the old Peale Museum.

Ammodramus savannarum borinquensis Peters

Ammodramus savannarum borinquensis Peters, Proc. Biol. Soc. Washington, **30**, 1917, p. 95.

Type.— No. 80,493, ♂; Porto Rico, Cabo Rojo; 5 February, 1917; J. L. Peters.

Coturniculus savannarum cracens Bangs and Peck

now Ammodramus savannarum cracens (Bangs and Peck)

Coturniculus savannarum cracens Bangs and Peck, Proc. Biol. Soc. Washington, **21**, 1908, p. 45.

Type.— No. 119,770, ♂; British Honduras, Ycacos Lagoon; 10 March, 1907; M. E. Peck.

Ammodramus caudacutus nelsoni Allen

now Passerherbulus caudacutus nelsoni (Allen)

Ammodromus caudacutus var. *nelsoni* Allen, Proc. Bost. Soc. N. H., **17**, 1875, p. 293.

Cotype.— No. 24,407; Illinois, Calumet Marshes (now South Chicago); October, 1874; E. W. Nelson.

Cotype.— No. 24,408; Illinois, Calumet Marshes (now South Chicago); October, 1874; E. W. Nelson.

† Ammodramus henslowii occidentalis Brewster

= Passerherbulus henslowii henslowii (Audubon)

Ammodramus henslowii occidentalis Brewster, Auk, **8**, (April), 1891, p. 145; separates issued in advance, February 17, 1891.

Type.— No. 225,959; South Dakota, Moody County; 16 June, 1882.

Emberiza henslowii Audubon, Orn. Biog., **1**, 1831, p. 360, pl. 70.

Passerherbulus henslowii susurrans Brewster

Passerherbulus henslowii susurrans Brewster, Proc. New Eng. Zoöl. Club, **6**, 1918, p. 77.

Type.— No. 205,260, ♂; Virginia, Falls Church; 12 July, 1879; P. L. Jouy.

Myospiza humeralis tucumanensis Bangs and Penard

Myospiza humeralis tucumanensis Bangs and Penard, Bull. Mus. Comp. Zoöl., **62**, 1918, p. 92.

Type.— No. 80,925, ♂; Tucuman, Tapia; 18 December, 1901; L. Dinelli.

Aimophila rufescens hypaethrus Bangs

Aimophila rufescens hypaethrus Bangs, Proc. Biol. Soc. Washington, **22**, 1909, p. 37.

Type.— No. 121,606, ♂; Costa Rica, Cerro Santa Maria; 4 January, 1908; C. F. Underwood.

Aimophila mcleodii Brewster

now Aimophila rufescens mcleodii Brewster

Aimophila mcleodii Brewster, Auk, **5**, 1888, p. 92.

Cotype.— No. 214,127, ♂; Chihuahua, El Carmen; 3 June, 1885; R. R. McLeod.

Cotype.— No. 214,128, ♀; Chihuahua, El Carmen; 10 November, 1884; R. R. McLeod.

† Aimophila cahooni Brewster

= Aimophila rufescens mcleodii Brewster

Aimophila cahooni Brewster, Auk, **5**, 1888, p. 93.

Cotype.— No. 214,129, ♂; Sonora, near Oposura; 2 June, 1887; J. C. Cahoon.

Cotype.— No. 214,130, ♀; Sonora, near Oposura; 31 May, 1887.

Aimophila mcleodii Brewster, Auk, **5**, 1888, p. 92.

Torreornis inexpectata Barbour and Peters

Torreornis inexpectata Barbour and Peters, Proc. New Eng. Zoöl. Club, **9**, 1927, p. 95.

Type.— No. 236,693, ♂; Cuba, Peninsula de Zapata, Santo Tomas; 2 March, 1927; F. Z. Cervera.

Amphispiza bilineata bangsi Grinnell

Amphispiza bilineata bangsi Grinnell, Auk, **44**, 1927, p. 71.

Type.— No. 215,968, ♂; Lower California, La Paz; 11 January, 1888; M. A. Frazar.

Emberiza hypocondria d'Orbigny and Lafresnaye

now Poospiza hypocondria (d'Orbigny and Lafresnaye)

Emberiza hypocondria d'Orbigny and Lafresnaye, Mag. Zoöl., 1837, p. 80.

Cotype.— No. 76,666; Lafresnaye Collection, no. 6,497; Bolivia, Sica sica; d'Orbigny.

There are two other cotypes in the Paris Museum.

Emberiza melanoleuca d'Orbigny and Lafresnaye

now Poospiza melanoleuca (d'Orbigny and Lafresnaye)

Emberiza melanoleuca d'Orbigny and Lafresnaye, Mag. Zoöl., 1837, p. 82.

Cotype.— No. 76,669; Lafresnaye Collection, no. 6,500; "Chiquitos" d'Orbigny.

Cotype.— No. 76,670; Lafresnaye Collection, no. 6,501; "Chiquitos" d'Orbigny.

Cotype.— No. 76,671, ♀; Lafresnaye Collection, no. 6,502; "Chiquitos"; d'Orbigny.

In the Paris Museum there are two males, one marked simply Bolivia, the other Corrientes, but no female. Dr. Hellmayr doubts that either of these should be considered cotypes since the type locality is Chiquitos.

Our female, No. 76,671, is the one from which the original description of the female was made.

Emberiza torquata d'Orbigny and Lafresnaye

now Poospiza torquata (d'Orbigny and Lafresnaye)

Emberiza torquata d'Orbigny and Lafresnaye, Mag. Zoöl., 1837, p. 82.

Cotype.— No. 76,667; Lafresnaye Collection, no. 6,503; Bolivia, Sica sica; d'Orbigny.

There is one adult in the Paris Museum, also a cotype.

Junco hyemalis carolinensis Brewster

Junco hyemalis carolinensis Brewster, Auk, **3**, 1886, p. 108.

Cotype.— No. 210,597, ♂; North Carolina, Black Mountains; 2 June, 1885; W. Brewster.

Cotype.— No. 210,567, ♀; North Carolina, Highlands; 28 May, 1885; W. Brewster.

Junco hyemalis connectens Coues

Junco hyemalis connectens Coues, Key to N. Am. Birds, 2nd ed., 1884, p. 378.

Type.— No. 207,046, ♀; Colorado, Colorado Springs; 26 April, 1882; W. Brewster.

Coues's *Junco h. connectens* was variously treated by different ornithologists in dealing with the genus, but was never looked upon as a valid form until Swarth found its breeding ground, and reinstated it (Univ. Cal. Publ. Zoöl., **24**, 1922, pp. 243–253).

† Fringilla socialis Wilson

= Spizella passerina passerina (Bechstein)

Fringilla socialis Wilson, Am. Orn., **2**, 1810, p. 127, pl. 16, fig. 5.

Type.— No. 67,858; from the old Peale Museum.

Fringilla passerina Bechstein, in Latham, Allg. Ueb. Vögel, **3**, pt. 2, 1798, p. 544, pl. 120, fig. 1.

Fringilla pusilla Wilson

now Spizella pusilla pusilla (Wilson)

Fringilla pusilla Wilson, Am. Orn., **2**, 1810, p. 121, pl. 16, fig. 2.

Type.— No. 67,859; from the old Peale Museum.

Spizella pusilla arenacea Chadbourne

Spizella pusilla arenacea Chadbourne, Auk, **3**, 1886, p. 248.

Type.— No. 230,468, ♀ ; Texas, Laredo; 12 November, 1885; F. B. Armstrong.

Spizella monticola ochracea Brewster

Spizella monticola ochracea Brewster, Bull. Nutt. Orn. Club, 7, 1882, p. 228.

Cotype.— No. 207,630, ♂; Washington, Fort Walla Walla; 8 November, 1881; C. E. Bendire.

Cotype.— No. 207,631, ♀ ; Washington, Fort Walla Walla; 13 December, 1881; C. E. Bendire.

Fringilla melodia Wilson

now Melospiza melodia melodia (Wilson)

Fringilla melodia Wilson, Am. Orn., **2**, 1810, p. 125, pl. 16, fig. 4.

Type.— No. 67,860; from the old Peale Museum.

Melospiza melodia acadica Thayer and Bangs

Melospiza melodia acadica Thayer and Bangs, Proc. New Eng. Zoöl. Club, **5**, 1914, p. 67.

Typr.— No. 65,643, ♂; Nova Scotia, Wolfville; 22 April, 1914; R. W. Tufts.

Todd refused to recognize this race when reviewing the eastern races of the song sparrow. Going over the large series of specimens again I do not agree with him, and find I can distinguish this form easily.

Melospiza melodia beata Bangs

Melospiza melodia beata Bangs, Proc. New Eng. Zoöl. Club, **4**, 1912, p. 85.

Type.— No. 44,704, ♂; Florida, Enterprise; 17 April, 1859; H. Bryant.

Melospiza fasciata merrilli Brewster

now Melospiza melodia merrilli Brewster

Melospiza fasciata merrilli Brewster, Auk, **13**, 1896, p. 46.

Type.— No. 246,026, ♂; Idaho, Fort Sherman; 6 March, 1895; J. C. Merrill.

Melospiza cinerea semidiensis W. S. Brooks

now Melospiza melodia semidiensis W. S. Brooks

Melospiza cinerea semidiensis W. S. Brooks, Proc. New Eng. Zoöl. Club, **7**, 1919, p. 27.

Type.— No. 67,069, ♂; North Semidi Island, Semidi Islands; 19 April, 1913; Mixter and Brooks.

† Melospiza lincolni striata Brewster

= Melospiza lincolni gracilis (Kittlitz)

Melospiza lincolni striata Brewster, Auk (April), 1889, p. 89; separates issued in advance, January 31, 1889.

Cotype.— No. 214,391, ♂; British Colombia, Comox; 8 September, 1888; E. H. Forbush.

Cotype.— No. 214,392, ♀; British Colombia, Comox; 8 September, 1888; E. H. Forbush.

Emberiza (*Zonotrichia*) *gracilis* Kittlitz, Denkw., Reise **1**, 1858, p. 199.

† Fringilla palustris Wilson

= Melospiza georgiana (Latham)

Fringilla palustris Wilson, Am. Orn., **3**, 1811, p. 49, pl. 22, fig. 1.

Type.— No. 67,861; from the old Peale Museum.

Fringilla georgiana Latham, Index Orn., **1**, 1790, p. 460.

† Passerella obscura Verrill

= Passerella iliaca iliaca (Merrem)

Passerella obscura Verrill, Proc. Bost. Soc. N. H., **9**, 1862, p. 143.

Cotype.— No. 775; Anticosti Island; 8 August, 1861; Verrill, Hyatt and Shaler.

Cotype.— No. 10,312 (referred to by Verrill as No. 620, but not

entered in the Catalogue under that number, but under no. 10,312); Anticosti Island; 1 July, 1861; Verrill, Hyatt and Shaler.

Fringilla iliaca Merrem, Beitr. Gesch. Vög., 1786–87, p. 49, pl. 10.

These specimens are in alcohol and in poor condition.

† Pipilo rufopileus Lafresnaye

= Oberholseria chlorurus (Audubon)

Pipilo rufopileus Lafresnaye, Rev. Zoöl., 1848, p. 176.

Type.— No. 77,043; Lafresnaye Collection, no. 6,586; Mexico.

Fringilla chlorura Audubon, Orn. Biog., **5**, 1839, p. 336.

Pipilo maculatus magnirostris Brewster

Pipilo maculatus magnirostris Brewster, Auk, **8** (April), 1891, p. 146; separates issued in advance, February 17, 1891.

Cotypes.— No. 216,070, ♂; Lower California, Sierra de la Laguna; 21 May, 1887; M. A. Frazar.

Cotype.— No. No. 216,081, ♀; Lower California, Sierra de la Laguna; 21 May, 1887; M. A. Frazar.

Pipilo alleni Coues

now Pipilo erythrophthalmus alleni Coues

Pipilo alleni Coues, Am. Nat., **5**, 1871, p. 366, footnote.

Cotypes.— No. 10,722, ♂; Florida, Dummitts Grove, Indian River; 26 February, 1869; C. J. Maynard.

Cotype.— No. 10,726, ♀; Florida, Dummitts Grove, Indian River; 22 March, 1869; C. J. Maynard.

Emberiza striaticeps Lafresnaye

now Arremonops striaticeps striaticeps (Lafresnaye)

Emberiza striaticeps Lafresnaye, Rev. et Mag. Zoöl., 1853, p. 61.

Type.— No. 76,583; Lafresnaye Collection, no. 6,583; Panama.

This species has lately been resurrected by Todd in his review of the genus Arremonops (Proc. Biol. Soc. Washington, **36**, 1923, pp. 35–44).

Arremonops conirostris centratus Bangs

now Arremonops striaticeps centratus Bangs

Arremonops conirostris centratus Bangs, Bull. Mus. Comp. Zoöl., **39**, 1903, p. 156.

Type.— No. 110,141, ♀; Honduras, Ceiba; 24 January, 1902; W. W. Brown.

† Arremonops conirostris canens Bangs

= Arremonops conirostris conirostris (Bonaparte)

Arremonops conirostris canens Bangs, Proc. Biol. Soc. Washington, **12**, 1898, p. 140.

Type.— No. 105,371, ♂; Colombia, Santa Marta; 15 January, 1898; W. W. Brown.

Arremon conirostris Bonaparte, Consp. Avium, **1**, 1850, p. 488.

Emberizoides sphenura lucaris Bangs

Emberizoides sphenura lucaris Bangs, Proc. New Eng. Zoöl. Club, **4**, 1908, p. 34.

Type.— No. 118,590, ♂; Costa Rica, Boruca; 5 May, 1906; C. F. Underwood.

Phrygilus punensis Ridgway

Phrygilus punensis Ridgway, Proc. U. S. Nat. Mus., **10**, 1887, p. 434.

Type.— No. 76,624; Lafresnaye Collection, no. 3,535; Bolivia, La Paz (d'Orbigny?).

Lafresnaye's label for this specimen reads, "Phrygilus Cabanis. Phry. major nob. in mus. nostro. Emba. gayi var. major cf. synop., p. 75 (Bolivia la Paz)."

Emberiza atriceps d'Orbigny and Lafresnaye

now Phrygilus atriceps (d'Orbigny and Lafresnaye)

Emberiza atriceps d'Orbigny and Lafresnaye, Mag. Zoöl., 1837, p. 76.

Cotype.— No. 76,622; Lafresnaye Collection, no. 6,533. "Sommet des andes, Tacora; d'Orbigny."

Cotype.— No. 76,623; Lafresnaye Collection, no. 6,534; "Sommet des andes; d'Orbigny."

There are, of course, cotypes and to this Dr. Hellmayr agrees, but in this instance he did not mention how many more specimens were in the Paris Museum.

Phrygilus malvinarum W. S. Brooks

Phrygilus malvinarum W. S. Brooks, Proc. New Eng. Zoöl. Club, **6**, 1916, p. 25.

Type.— No. 70,431; West Falkland Island, Port Stephens; 1 February, 1916; W. S. Brooks.

Haplospiza nivaria Bangs

now Phrygilus unicolor nivarius (Bangs)

Haplospiza nivaria Bangs, Proc. Biol. Soc. Washington, **13**, 1899, p. 102.

Type.— No. 106,238, ♂; Colombia, Santa Marta Mountains, Paramo de Chiruqua; 25 March, 1899; W. W. Brown.

† Pipilo cinerea Peale

= Diuca diuca diuca (Molina)

Pipilo cinerea Peale, U. S. Expl. Exped., 1848, p. 123.

Cotype.— No. 75,875, ♂; Chili; U. S. Expl. Exped.

Fringilla diuca Molina, Saggio Hist. Nat. Chili, 1782, p. 249.

Peale gives no clue to the number of specimens he secured, saying only that the species was abundant in May along the road from Valparaiso to St. Jago.

Emberiza speculifera d'Orbigny and Lafresnaye

now Diuca speculifera (d'Orbigny and Lafresnaye)

Emberiza speculifera d'Orbigny and Lafresnaye, Mag. Zoöl., 1837, p. 78.

Cotype.— No. 76,618; Lafresnaye Collection, no. 6,525; "Bolivie sur les andes"; d'Orbigny.

Lafresnaye's label for this specimen is a good sample of those he wrote for all his d'Orbigny birds. The labels were made out at the time of description, with reference to plate number and figure of d'Orbigny's voyage left blank. These were added at a later date as may be seen from the different ink used at the later date "Emb. speculifera nob. synop., p. 78, d'orb. voy. 46, 1. Bolivie sur les andes."

EMBERIZA GRISEOCRISTATA d'Orbigny and Lafresnaye

now SCHISTOSPIZA GRISEOCRISTATA (d'Orbigny and Lafresnaye)

Emberiza griseocristata d'Orbigny and Lafresnaye, Mag. Zoöl., 1837, p. 79.

Cotype.— No. 76,620; Lafresnaye Collection, no. 6,482; Bolivia, "Grande = Vallée, Cochabamba"; d'Orbigny.

In the Paris Museum there is one adult male and one young, both also cotypes.

NEMOSIA NIGROGENIS Lafresnaye

now PAROARIA NIGROGENIS (Lafresnaye)

Nemosia nigro-genis Lafresnaye, Rev. Zoöl., 1846, p. 273.

Type.— No. 77,044; Lafresnaye Collection, no. 6,488; "embouch. de l'orenoque."

TACHYPHONUS CAPITATUS d'Orbigny and Lafresnaye

now PAROARIA CAPITATUS d'Orbigny and Lafresnaye

Tachyphonus capitatus d'Orbigny and Lafresnaye, Mag. Zoöl., 1837, p. 29.

Cotype.— No. 76,625; Lafresnaye Collection, no. 6,491; Argentina, Corrientes; d'Orbigny.

Four more cotypes are in the Paris Museum.

ARREMON AURANTIIROSTRIS Lafresnaye

now ARREMON AURANTIIROSTRIS AURANTIIROSTRIS Lafresnaye

Arremon aurantiirostris Lafresnaye, Rev. Zoöl., 1847, p. 72.

Cotype.— No. 76,675; Lafresnaye Collection, no. 3,165: Panama.

Lafresnaye's written label is as follows "Ar. aurantiirostris, Ar. à bec orange Nob. rev., 1847, p. 72. Desmurs icon., pl. 55, Panama am. centrale."

Our specimen from the type locality and with such a label must be considered a cotype. To this Dr. Stone agrees. The other cotype, listed by Stone (Proc. Acad. Nat. Sci. Phil., 1899, p. 51) does not carry the full reference to the type locality as it appears in the original description, "Am. centrale" being omitted.

ARREMON GUTTURALIS Lafresnaye

now ATLAPETES GUTTURALIS GUTTURALIS (Lafresnaye)

Arremon gutturalis Lafresnaye, Rev. Zoöl., 1843, p. 98.

Type.— No. 76,678; Lafresnaye Collection, no. 3,150; "Bolivie"= Colombia.

EMBERNAGRA ALBINUCHA d'Orbigny and Lafresnaye

now ATLAPETES ALBINUCHA (d'Orbigny and Lafresnaye)

Embernagra albinucha d'Orbigny and Lafresnaye, Rev. Zoöl., 1838, p. 165.

Type.— No. 76,676; Lafresnaye Collection, no.3,144; "Carthayene."

The several species described in the above quoted article by d'Orbigny and Lafresnaye were all from the Lafresnaye Collection.

TANAGRA ALBOFRENATUS Boissonneau

now ATLAPETES ALBOFRENATUS (Boissonneau)

Tanagra (Arremon) albo-frenatus Boissonneau, Rev. Zoöl., 1840, p. 68.

Type.— No. 76,116; Lafresnaye Collection, no. 3,146; Bogotá.

ATLAPETES CRASSUS Bangs

now ATLAPETES TRICOLOR CRASSUS Bangs

Atlapetes crassus Bangs, Proc. Biol. Soc. Washington, **21**, 1908, p. 161.

Type.— No. 120,524, ♂; Colombia, San Antonio, Rio Cali; 11 December, 1904; M. G. Palmer.

TANAGRA SCHISTACEUS Boissonneau

now ATLAPETES SCHISTACEUS (Boissonneau)

Tanagra (Arremon) schistaceus Boissonneau, Rev. Zoöl., 1840, p. 69.

Type.— No. 76,113; Lafresnaye Collection, no. 3,152; Bogotá.

TANAGRA SEMIRUFUS Boissonneau

now ATLAPETES SEMIRUFUS (Boissonneau)

Tanagra (Arremon) semirufus Boissonneau, Rev. Zoöl., 1840, p. 69.

Type.— No. 76,108; Lafresnaye Collection, no. 3,155; Bogotá.

BUARREMON BASILICUS Bangs

Buarremon basilicus Bangs, Proc. Biol. Soc. Washington, **12**, 1898, p. 159.

Type.— No. 105,598, ♂; Colombia, Santa Marta Mountains, Pueblo Viejo; 21 March, 1898; W. W. Brown.

EMBERNAGRA BRUNNEINUCHA Lafresnaye

now BUARREMON BRUNNEINUCHA BRUNNEINUCHA (Lafresnaye)

Embernagra brunneinucha Lafresnaye, Rev. Zoöl., 1839, p. 97.

Type.— No. 76,679; Lafresnaye Collection, no. 3,138; "Sta fé de Bogotá."

BUARREMON COSTARICENSIS Bangs

Buarremon costaricensis Bangs, Auk, **24**, 1907, p. 310.

Type.— No. 118,606, ♂; Costa Rica, Boruca; 1 July, 1906; C. F. Underwood.

EUNEORNITHIDAE

† TACHYPHONUS RUFOGULARIS Lafresnaye

= EUNEORNIS CAMPESTRIS (Linné)

Tachyphonus rufo-gularis Lafresnaye, Rev. Zoöl., 1846, p. 320.

Type.— No. 77,045; Lafresnaye Collection, no. 3,232; "Jamaique."

Motacilla campestris Linné, Syst. Nat., **1**, 1758, p. 184.

Two additional specimens in the Lafresnaye Collection, nos. 3,231 and 3,233, were apparently acquired by the Baron at a later date, because he correctly identified them as "Tan. ruficollis lat." — for a long time the current name of the species.

COEREBIDAE

CERTHIOLA CABOTI Baird

now COEREBA CABOTI (Baird)

Certhiola caboti Baird, Am. Nat., **7**, 1873, p. 612.

Type.— No. 72,525; Cozumel Island, off Yucatan; S. Cabot.

COEREBA CERINOCLUNIS Bangs

now COEREBA LUTEOLA CERINOCLUNIS Bangs

Coereba cerinoclunis Bangs, Proc. New Eng. Zoöl. Club, **2**, 1901, p. 51.

Type.— No. 104,962, ♂; San Miguel Island, Pearl Islands, Bay of Panama; 29 April, 1900; W. W. Brown.

This form and the next are probably better regarded as subspecies of *luteola*.

Coereba gorgonae Thayer and Bangs

now Coereba luteola gorgonae Thayer and Bangs

Coereba gorgonae Thayer and Bangs, Bull. Mus. Comp. Zoöl., **46**, 1905, p. 97.

Type.— No. 114,009, ♂; Gorgona Island, off western Colombia; 28 June, 1904; W. W. Brown.

Serrirostrum sittoides d'Orbigny and Lafresnaye

now Diglossa sittoides sittoides (d'Orbigny and Lafresnaye)

Serrirostrum sittoides d'Orbigny and Lafresnaye, Mag. Zoöl., 1838, Syn., p. 25.

Cotype.— No. 76,714; Lafresnaye Collection, no. 5,786; "Bolivie, Yungas"; d'Orbigny.

In the Paris Museum there is one adult male from Yungas and one adult male from Valle Grande.

Diglossa similis Lafresnaye

now Diglossa sittoides similis Lafresnaye

Diglossa similis Lafresnaye, Rev. Zoöl., 1846, p. 318.

Type.— No. 76,716; Lafresnaye Collection, no. 5,791; Colombia.

Diglossa mystacalis Lafresnaye

Diglossa mystacalis Lafresnaye, Rev. Zoöl., 1846, p. 318.

Type.— No. 76,717; Lafresnaye Collection, no. 5,777; Bolivia.

Diglossa aterrima Lafresnaye

Diglossa aterrima Lafresnaye, Rev. Zoöl., 1846, p. 319.

Type.— No. 76,704; Lafresnaye Collection, no. 5,783; "Nlle. Grenad. Pasto."

Lafresnaye received the type from Delattre. There is another specimen, No. 5,782, probably received by Lafresnaye at a later date, with a differently worded label that simply says "*Diglossa aterrima* Nlle. Grenade," without the "nob." or the type locality Pasto.

Diglossa nocticolor Bangs

now Diglossa carbonaria nocticolor Bangs

Diglossa nocticolor Bangs, Proc. Biol. Soc. Washington, **12**, 1898, p. 180.

Type.— No. 105,610, ♂; Colombia, Santa Marta Mountains, Macotama; 17 June, 1898; W. W. Brown.

Diglossa albilatera Lafresnaye

now Diglossa albilatera albilatera Lafresnaye

Diglossa albi-latera Lafresnaye, Rev. Zoöl., 1846, p. 319.

Type.— No. 76,711; Lafresnaye Collection, no. 5,784; Colombia.

† Uncirostrum cyaneum Lafresnaye

= Diglossa personata personata (Fraser)

Uncirostrum cyaneum Lafresnaye, Rev. Zoöl., 1840, p. 102.

Cotype.— No. 76,723; Lafresnaye Collection, no. 5,772; Bogotá.
Cotype.— No. 76,724; Lafresnaye Collection, no. 5,773; Bogotá.

Agrilorhinus personata Fraser, P. Z. S., 1840, p. 23.

Exactly similar labels for his two specimens were written by Lafresnaye, so they must both be considered cotypes.

Conirostrum sitticolor Lafresnaye

now Conirostrum sitticolor sitticolor Lafresnaye

Conirostrum sitticolor Lafresnaye, Rev. Zoöl., 1840, p. 102.

Type.— No. 76,708; Lafresnaye Collection, no. 5,803; "sta Fé de Bogotá."

Conirostrum rufum Lafresnaye

Conirostrum rufum Lafresnaye, Mag. Zoöl., 1843, Ois., pl. 35, text, p. 3.

Type.— No. 76,702; Lafresnaye Collection, no. 5,806; Bogotá.

Besides the type Lafresnaye had two specimens, nos. 5,805 and 5,807. The labels for these two are not like that of the type and bear several names, all questioned.

Conirostrum albifrons Lafresnaye

Conirostrum albifrons Lafresnaye, Rev. Zoöl., 1842, p. 301.

Type.— No. 76,718; Lafresnaye Collection, no. 5,799; Colombia.

Lafresnaye had three males of this species; of the others, no. 5,800 is the individual mentioned by Lafresnaye as having some olive green feathers in its plumage, and no. 5,801 a fully adult with a pure white cap was acquired later (see Rev. Zoöl., 1848, p. 10). The type is easily identified by both the description and the plate (Mag. Zoöl., 1843, Ois., pl. 35).

† Conirostrum caeruleifrons Lafresnaye

= Conirostrum albifrons, ♀, Lafresnaye

Conirostrum caeruleifrons Lafresnaye, Rev. Zoöl., 1842, p. 302.

Type.— No. 76,721; Lafresnaye Collection, no. 5,797; Colombia.

Conirostrum albifrons Lafresnaye, Rev. Zoöl., 1842, p. 301.

Conirostrum atrocyaneum Lafresnaye

Conirostrum atro-cyaneum Lafresnaye, Rev. Zoöl., 1848, p. 9.

Type.— No. 76,706; Lafresnaye Collection, no. 5.796; Colombia (now Ecuador) "près de Rio Napo."

Dacnis napaea Bangs

now Dacnis coerebicolor napaea Bangs

Dacnis napaea Bangs, Proc. Biol. Soc. Washington, **12**, 1898, p. 143.

Type.— No. 105,478, ♂; Colombia, Santa Marta; 18 January, 1898; W. W. Brown.

Dacnis cyanea callaina Bangs

Dacnis cyanea callaina Bangs, Proc. Biol. Soc. Washington, **18**, 1905, p. 154.

Type.— No. 108,200, ♂; Panama, Divala; 2 November, 1900; W.W. Brown.

Dacnis venusta fuliginata Bangs

Dacnis venusta fuliginata Bangs, Proc. Biol. Soc. Washington, **21**, 1908, p. 160.

Type,— No. 120,229, ♂; western Colombia, Jimenez; 23 February, 1907; M. G. Palmer.

Dacnis leucogenys Lafresnaye

now Ateleodacnis leucogenys (Lafresnaye)

Dacnis leucogenys Lafresnaye, Rev. Zoöl., 1852, p. 470.

Type.— No. 76,700; Lafresnaye Collection, no. 5,766; Colombia.

I am, of course, aware that this genus, as also *Conirostrum*, has by some ornithologists recently been associated with the Mniotiltidae. I do not feel at all sure that this disposition of either genus is correct, and prefer to wait for a thorough anatomical study of the obviously heterogeneous Coerebidae.

† CYANERPES CYANEUS RAMSDENI Bangs

= CYANERPES CYANEUS CYANEUS (Linné)

Cyanerpes cyaneus ramsdeni Bangs, Proc. New Eng. Zoöl. Club, **4**, 1913, p. 91.

Type.— No. 61,102, ♂; Cuba, Guantanamo, Rio Seco; 8 March, 1913; T. Barbour.

Certhia cyanea Linné, Syst. Nat., ed. 12, **1**, 1766, p. 188.

The characters that I supposed distinguished the Cuban bird prove not to be constant, and perhaps the species was introduced into Cuba.

CYANERPES GIGAS Thayer and Bangs

now CYANERPES CYANEUS GIGAS Thayer and Bangs

Cyanerpes gigas Thayer and Bangs, Bull. Mus. Comp. Zoöl., **46**, 1905, p. 96.

Type.— No. 114,007, ♂; Gorgona Island, off western Colombia; 26 June, 1904; W. W. Brown.

CYANERPES LUCIDUS ISTHMICUS Bangs

Cyanerpes lucidus isthmicus Bangs, Auk, **24**, 1907, p. 306.

Type.— No. 118,325, ♂; Costa Rica, Boruca, Paso Real; 22 July, 1906; C. F. Underwood.

CHLOROPHANES SPIZA ARGUTA Bangs and Barbour

Chlorophanes spiza arguta Bangs and Barbour, Bull. Mus. Comp. Zoöl., **65**, 1922, p. 225.

Type.— No. 108,199, ♂; Panama, Divala; 29 October, 1900; W. W. Brown.

TERSINIDAE

TERSINA VIRIDIS GRISESCENS Griscom

Tersina viridis grisescens Griscom, Bull. Mus. Comp. Zoöl., **69**, 1929, p. 186.

Type.— No. 106,300, ♀; Colombia, Santa Marta Mountains, La Concepcion; 14 February, 1899; W. W. Brown.

THRAUPIDAE

CHLOROPHONIA FRONTALIS PSITTACINA Bangs

Chlorophonia frontalis psittacina Bangs, Proc. New Eng. Zoöl. Club, **3**, 1902, p. 88.

Type.— No. 106,042, ♂; Colombia, Santa Marta Mountains, La Concepcion; 18 February, 1899; W. W. Brown.

† Tanagra pretrei Lafresnaye

= Chlorophonia pyrrhophrys (Sclater)

Tanagra (Euphonia) pretrei Lafresnaye, Rev. Zoöl., 1843, p. 97. (Not *Tanagra pretrei* Lesson, 1830).

Type.— No. 76,905; Lafresnaye Collection, no. 2,816; "Colombie."

Euphonia pyrrhophrys Sclater, Contrib. Orn., 1851, p. 89, pl. 75, fig. 2, ♀.

Two additional specimens, nos. 2,815 and 2,817, in the Lafresnaye Collection are not cotypes.

† Euphonia flavifrons viscivora Clark

= Tanagra flavifrons (Sparrmann)

Euphonia flavifrons viscivora Clark, Proc. Biol. Soc. Washington, **18**, 1895, p. 19.

Type.— No. 112,687, ♂; Lesser Antilles, St. Vincent; October, 1903; A. H. Clark.

Emberiza flavifrons Sparrmann, Mus. Carls., **4**, 1789, no. 92.

All color characters claimed by Clark to distinguish a form in the southern Lesser Antilles entirely break down in the light of the long series now available. Neither are there any differences in size perceptible. All birds from the Lesser Antilles must be given Sparrmann's name.

Euphonia serrirostris d'Orbigny and Lafresnaye

now Tanagra serrirostris (d'Orbigny and Lafresnaye)

Euphonia serrirostris d'Orbigny and Lafresnaye, Mag. Zoöl., 1837, Syn., Av., p. 30.

Type.— No. 77,180; Lafresnaye Collection, no. 2,833 bis. "Guarayos, S. Cruz, Bolivia"; d'Orbigny.

Hellmayr has kindly examined this specimen, and pronounces it the "type of the so-called adult male." He also says that he never has seen anything like it and that, therefore, his note in Nov. Zoöl., **30**, 1923, p. 230–1, requires correction. There are no specimens in the Paris Museum that at all correspond to pl. 22, fig. 1 [= ♂], which was obviously taken from no. 77,180, listed above as the type.

Tanagra olivacea mellea Bangs and Penard

Tanagra olivacea mellea Bangs and Penard, Bull. Mus. Comp. Zoöl., **62**, 1918, p. 87.

Type.— No. 123,020, ♂; Peru, Yquitos; Dr. Hahnel.

† Tanagra violacea rodwayi Penard

= Tanagra violacea violacea (Linné)

Tanagra violacea rodwayi Penard, Proc. New Eng. Zoöl. Club, **7**, 1919, p. 30.

Type.— No. 82,135, ♂; Mount Roraima, 3,500 feet altitude; 1 January, 1884; H. Whitley.

Fringilla violacea Linné, Syst. Nat., ed. 10, **1**, 1758, p. 182.

The type is a rather large individual and is wholly purplish above, these peculiarities, however, prove to be only individual. A fine adult male from Roraima (no. 237,292, American Mus. N. H.) kindly lent me by Dr. Chapman is in every way similar to birds from other parts of the Guianas and from Trinidad.

Tanagra chrysopasta nitida Penard

Tanagra chrysopasta nitida Penard, Occ. Papers Bost. Soc. N. H., **5**, 1923, p. 63.

Type.— No. 93,415, ♂; Surinam, Lelydorp; 7 September, 1921, T. E. Penard.

Tanagra gouldi praetermissa Peters

Tanagra gouldi praetermissa Peters, Bull. Mus. Comp. Zoöl., **69**, 1929, p. 470.

Type.— No. 234,428, ♂; Panama, Western River, Almirante; 28 February, 1926; J. D. Smith.

† Euphonia cinerea Lafresnaye

= Pyrrhuphonia jamaica (Linné)

Euphonia cinerea Lafresnaye, Rev. Zoöl., 1846, p. 277.

Type.— No. 76,995; Lafresnaye Collection, no. 2,866; "Il vient de Colombie" (error, = Jamaica).

Fringilla jamaica Linné, Syst. Nat., 1766, p. 323.

Tanagra aurulenta Lafresnaye

now Tangara aurulenta aurulenta (Lafresnaye)

Tanagra (Aglaia) aurulenta Lafresnaye, Rev. Zoöl., 1843, p. 290.

Type.— No. 76,912; Lafresnaye Collection, no. 2,898; Colombia.

The type, a fine adult in perfect condition, agrees with birds from the eastern Andes, and undoubtedly was a Bogotá "trade skin."

Calliste sclateri Lafresnaye

now Tangara sclateri (Lafresnaye)

Calliste sclatteri (sic) Lafresnaye, Rev. and Mag. Zoöl., 1854, p. 207.

Type.— No. 76,911; Lafresnaye Collection, no. 2,899; "Colombie."

Lafresnaye's label for this specimen reads "Cal. Brunneiventris nob. in Mo; No. Colombie"; he changed the specific name, probably after reading Sclater's Contr. Ornith., 1851, pt. 11, p. 52 dealing with *Calospiza aurulenta* and *C. pulchra*. Sclater evidently mistook this species for *C. aurulenta* Lafresnaye.

Calospiza lavinia cara Bangs

now Tangara lavinia cara (Bangs)

Calospiza lavinia cara Bangs, Proc. Biol. Soc. Washington, **18**, 1905, p. 155.

Type.— No. 110,024, ♂; Honduras, Ceiba; 9 January, 1902; W. W. Brown.

† Calospiza gyroloides deleticia Bangs

= Tangara gyroloides gyroloides (Lafresnaye)

Calospiza gyroloides deleticia Bangs, Proc. Biol. Soc. Washington, **21**, 1908, p. 160.

Type.— No. 120,508, ♂; Western Colombia, San Antonio, Rio Cali; 6 December, 1907; M. G. Palmer.

Aglaia perwiana Swainson, Anin Menag., 1838 (published December, 1837), p. 356 (not *Tanagra peruviana* Desmarest, Hist. Nat. Tangaras, etc., 1805).

Aglaia gyroloides Lafresnaye, Rev. Zoöl., 1847, p. 277 (new name for *Aglaia peruviana* Swainson, preoccupied).

Hellmayr (P. Z. S., 1911, p. 1,104) contends that Swainson's bird did not come from Peru, but was the Colombian form that I named *deleticia*. Zimmer who at present is hard at work on Peruvian birds, writes me that he is of the same opinion.

Tangara gyroloides nupera Bangs

Tangara gyroloides nupera Bangs, Proc. New Eng. Zoöl. Club, **6**, 1917, p. 76.

Type.— No. 74,066, ♂; Ecuador, Nanegal.

Chapman (Distribution of Bird-Life in Ecuador, 1926) entirely overlooked my name, and continues to call the Ecuadorian form *bangsi*. (Cf. Griscom, Bull. Mus. Comp. Zoöl., **69**, 1929, p. 188).

Aglaia viridissima Lafresnaye

now Tangara viridissima viridissima (Lafresnaye)

Aglaia viridissima Lafresnaye, Rev. Zoöl., 1847, p. 277.

Type.— No. 76,921; Lafresnaye Collection, no. 2,920.

Lafresnaye did not know whence his type came. He wrote three labels for it, and on the third guesses "Trinidad, Venezuela, Caracas?" The specimen probably did come from Trinidad, as it exactly matches recently collected examples from there.

A second specimen, no. 2,921, is not a cotype, as Lafresnaye mentions that he had but one when he described the species — "notre individu a été rapporté d'une des îles de l'amérique centrale par un officier anglais."

Tangara viridissima toddi Bangs and Penard

Tangara viridissima toddi Bangs and Penard, Proc. Biol. Soc. Washington, **34**, 1921, p. 92.

Type.— No. 106,342, ♂; Colombia, Santa Marta Mountains, San Francisco; 7 February, 1899; W. W. Brown.

Tangara inornata languens Bangs and Barbour

Tangara inornata languens Bangs and Barbour, Bull. Mus. Comp. Zoöl., **65**, 1922, p. 227.

Type.— No. 107,508, ♂; Panama, Loma del Leon; 25 March, 1900; W. W. Brown.

Tanagra nigroviridis Lafresnaye

now Tangara nigroviridis (Lafresnaye)

Tanagra nigro viridis (two words!) Lafresnaye, Rev. Zoöl., 1843, p. 69; figured, Mag. Zoöl., 1843, pl. 43.

Type.— No. 76,975; Lafresnaye Collection, no. 2,936; Bogotá.

Three other specimens in the Lafresnaye Collection, nos. 2,936, 2,937 and 8,500 are not cotypes.

† Aglaia wilsonie Lafresnaye

= Tangara nigrocincta (Bonaparte)

Aglaia Wilsonie Lafresnaye, Rev. Zoöl., 1847, p. 71.

Cotype.— No. 76,997; Lafresnaye Collection, no. 2,941; "Peruvia, Guanco."

Aglaia nigro-cincta Bonaparte, P. Z. S., 1837, p. 121.

Another cotype is in the collection of the Academy of Natural Sciences at Philadelphia (Stone, Proc. Acad. Nat. Sci. Phil., 1899, p. 51).

Tanagra parzudakii Lafresnaye

now Tangara parzudakii (Lafresnaye)

Tanagra Parzudakii Lafresnaye, Rev. Zoöl., 1843, p. 97; figured Mag. Zoöl., 1843, Ois., pl. 41.

Type.— No. 76,918; Lafresnaye Collection, no. 2,947; Bogotá.

Lafresnaye bought two skins from Parzudaki, and wrote one label for both; the other, no. 2,948, was an immature with greenish edges to the feathers, and did not figure in the description of the species, and, therefore, is not a cotype.

† Tangara parzudakii florentes Bangs and Noble

= Tangara parzudakii (Lafresnaye)

Tangara parzudakii florentes Bangs and Noble, Auk, **35**, 1918, p. 459.

Type.— No. 79,675, ♀; Peru, Charapí; 6 September, 1916; G. K. Noble.

Tanagra Parzudakii Lafresnaye, Rev. Zoöl., 1843, p. 97

As Chapman has shown, our type of this supposed subspecies happened to be an unusually large individual, and the form has no standing,

Tanagra labradorides Boissonneau

now Tangara labradorides labradorides (Boissonneau)

Tanagra (Aglaia) labradorides Boissonneau, Rev. Zoöl., 1840, p. 67.

Type.— No. 76,101; Lafresnaye Collection, no. 2,946; Bogotá.

† Tanagra argentea Lafresnaye

= Tangara cyanoptera (Swainson)

Tanagra (S. G. *Aglaia* Sw.) *argentea* Lafresnaye, Rev. Zoöl., 1843, p. 69.

Type.— No. 76,916; Lafresnaye Collection, no. 2,911; "Bogotá ou Caracas."

Aglaia cyanoptera Swainson, Orn. Drawn., 1841, pl. 8.

† Tanagra atricapilla Lafresnaye

= Tangara heinei (Cabanis)

Tanagra (*Aglaia*) *atricapilla* Lafresnaye, Rev. Zoöl., 1843, p. 290; (not *Tanagra atricapilla* Gmelin).

Type.— No. 76,923; Lafresnaye Collection, no. 2,931; "Colombie."

Procnias heinei Cabanis, Mus. Hein., **1**, 1850, p. 31.

Three other Lafresnaye specimens, nos. 2,932, 2,933, and 2,934, have differently worded labels, and are not cotypes.

Arremon rufivertex Lafresnaye

now Iridosornis rufivertex rufivertex (Lafresnaye)

Arremon rufi-vertex Lafresnaye, Rev. Zoöl., 1842, p. 335.

Cotype.— No. 76,981; Lafresnaye Collection, no. 2,951; Bolivia.

Cotype.— No. 76,982; Lafresnaye Collection, no. 2,950; Bolivia.

While the two specimens listed above must, from the text of their labels, be considered cotypes, a third, no. 2,952, certainly is not.

Tanagra palpebrosa Lafresnaye

now Poecilothraupis palpebrosa palpebrosa (Lafresnaye)

Tanagra palpebrosa Lafresnaye, Rev. Zoöl., 1847, p. 71.

Cotype.— No. 76,985; Lafresnaye Collection, no. 2,955; "Perou, pasto."

Another cotype listed by Stone (Proc. Acad. Nat. Sci. Phila., 1899, p. 51) as the type, is in the collection of the Academy of Natural Sciences, Philadelphia.

Aglaia montana d'Orbigny and Lafresnaye

now Buthraupis montana (d'Orbigny and Lafresnaye)

Aglaia montana d'Orbigny and Lafresnaye, Mag. Zoöl., 1837, syn., p. 32.

Cotype.— No. 76,984; Lafresnaye Collection, no. 2,958; "Bolivie"; d'Orbigny.

Hellmayr consider this specimen a cotype, although "yungas" was omitted from the label written for it by Lafresnaye. There is another cotype in the Paris Museum.

Tanagra eximia Boissonneau

now Buthraupis eximia eximia (Boissonneau)

Tanagra (gros-bec) *eximia* Boissonneau, Rev. Zoöl., 1840, p. 66.

Type.— No. 76,099; Lafresnaye Collection, no. 2,959; "Santa fé de Bogotá."

The label that Lafresnaye wrote for this specimen is characteristic of those he wrote for all the birds described in the above cited article by Boissonneau. As it also is rather interesting, I give it in full — "tanagra eximia Bo. nob. rev. zoöl., 1840, p. 66 (Sta. fé de Bogotá). Stephanophorus ? Stric., 1841, gray. Steph. eximia nob.; Saltator ? eximia n. boiss. rev., 1840, p. 66 — tang. Somptueux less. compl. à buf., p. 346, Colombie."

I agree with Chapman that it is hardly necessary to separate this species generically from *Buthraupis* as *Cnemothraupis* Penard.

Tachyphonus victorini Lafresnaye

now compsocoma somptuosa victorini (Lafresnaye)

Tachyphonus Victorini Lafresnaye, Rev. Zoöl., 1842, p. 336.

Cotype.— No. 76,987; Lafresnaye Collection, no. 2,961; "Colombie."

Cotype.— No. 76,988; Lafresnaye Collection, no. 2,962; "Colombie."

Lafresnaye wrote labels exactly alike for these two specimens, which are, therefore, of course, cotypes.

Lafresnaye tells us (*l. c.*, p. 336) that he had intended to name this species *flavi-vertex*, but found it already named in "la musée Massena." Of course, Lafresnaye's birds from which he drew his description and not Massena's are the types.

Tachyphonus flavinucha d'Orbigny and Lafresnaye

now Compsocoma flavinucha (d'Orbigny and Lafresnaye)

Tachyphonus flavinucha d'Orbigny and Lafresnaye, Mag. Zoöl., 1837, syn., p. 29.

Cotype.— No. 76,986; Lafresnaye Collection, no. 2,965; "Yungas, Bolivie"; d'Orbigny.

There are other cotypes in the Paris Museum.

Tanagra taeniata Boissonneau

now Dubusia taeniata (Boissonneau)

Tanagra (*Tachyphonus*) *taeniata* Boissonneau, Rev. Zoöl., 1840, p. 67.

Type.— No. 76,097; Lafresnaye Collection, no. 2,966; "Sta. fé de Bogotá."

Thraupis cana quaesita Bangs and Noble

Thraupis cana quaesita Bangs and Noble, Auk, **35**, 1918, p. 460.

Type.— No. 79,692, ♂; Peru, Sullana; 30 July, 1916; G. K. Noble.

† Tanagra cana dilucida Thayer and Bangs

= Thraupis cana diaconus (Lesson)

Tanagra cana dilucida Thayer and Bangs, Bull. Mus. Comp. Zoöl., **46**, 1905, p. 157.

Type.— No. 114,482, ♂; San Miguel Island, Pearl Islands, Bay of Panama; 25 February, 1904; W. W. Brown.

Tanagra (*aglaia*) *diacanus* Lesson, Rev. Zoöl., 1842, p. 175.

I think Berlepsch is right in relegating this supposed island form to synonymy. It is true that some of the island specimens have very long bills, but others do not, and are indistinguishable from mainland examples. The long bill seems to be only a tendency and not a fixed character of the island form.

Tanagra olivicyanea Lafresnaye

now Thraupis olivicyanea (Lafresnaye)

Tanagra olivi-cyanea Lafresnaye, Rev. Zoöl., 1843, p. 69.

Type.— No. 76,994; Lafresnaye Collection, no. 2,995; "Colombie; Parzud."

Tanagra dominicensis Bryant

now Spindalis dominicensis (Bryant)

Tanagra dominicensis Bryant, Proc. Bost. Soc. N. H., **11**, 1867, p. 92.

Type.— No. 73,945 (formerly U. S. Nat. Mus., no. 42,448), ♂; Haiti, Port au Prince; 10 June, 1866; A. C. Younglove.

Penard and I (Bull. Mus. Comp. Zoöl., **67**, 1925, p. 207) called this specimen a cotype, but since that time we have been unable to locate any other cotypes, and I must now, therefore, consider it the type of the species.

† Spindalis pretrei pinus Bangs and Zappey

= Spindalis pretrei (Lesson)

Spindalis pretrei pinus Bangs and Zappey, Am. Naturalist, **39**, 1905, p. 213.

Type.— No. 113,317, ♂; Isle of Pines, near Cuba, Santa Fé; 18 April, 1904; W. R. Zappey.

Tanagra Pretrei Lesson, Cent. Zoöl., 1839, p. 122, pl. 45.

While at one time I thought the Isle of Pines Spindalis a good form, I now agree with Barbour that it is indistinguishable from the Cuban *pretrei*.

Ramphocelus dimidiatus Lafresnaye

now Ramphocelus dimidiatus dimidiatus Lafresnaye

Ramphocelus dimidiatus Lafresnaye, Mag. Zoöl., 1837, cl. 2, pl. 81, text, p. 2 and plate.

Cotype.— No. 77,008, [♂]; Lafresnaye Collection, no. 3,016; "Mexique, Carthagene." (The first named locality of course, an error).

Cotype.— No. 77,009, [♀]; Lafresnaye Collection, no. 3,018;" Carthagine."

Ramphocelus limatus Bangs

now Ramphocelus dimidiatus limatus Bangs

Rhamphocelus limatus Bangs, Auk, **18**, 1901, p. 31.

Type.— No. 104,990, ♂; San Miguel Island, Pearl Islands, Bay of Panama; 4 May, 1900; W. W. Brown.

† Ramphocelus luciani Lafresnaye

= Ramphocelus melanogaster melanogaster Swainson

Ramphocelus Luciani Lafresnaye, Rev. Zoöl., 1838, p. 54; figured, Mag. Zoöl., 1839, Ois., pl. 2.

Type.— No. 77,011; Lafresnaye Collection, no. 3,019; "Carthagene" (error = Peru).

Ramphocelus melanogaster Swainson, Anim. Men., 1838 (published in December, 1837), p. 359.

Lafresnaye's type of his *T. luciani* is absolutely identical with Peruvian examples of *R. melanogaster* (cf. Zimmer, Proc. Biol. Soc. Washington, **42**, 1929, p. 97). Swainson's name for this species appeared first.

The specimen in the American Museum from Panama, collected by McLennan, is the same as *R. dunstalli* Rothschild, and not as Ridgway (Birds of North and Middle America) supposed *R. luciani*. *R. dunstalli* as well as *R. inexpectatus* are probably not "species," but are without doubt color aberrations.

Ramphocelus venezuelensis Lafresnaye

now Ramphocelus carbo venezuelensis Lafresnaye

Ramphocelus Venezuelensis Lafresnaye, Rev. and Mag. de Zoöl., 1853, p. 243.

Cotype.— No. 77,017 (♂); Lafresnaye Collection, no. 3,008; Caracas.

Cotype.— No. 77,018 (♂); Lafresnaye Collection, no. 3,009; Caracas.

Ramphocelus magnirostris Lafresnaye

now Ramphocelus carbo magnirostris Lafresnaye

Ramphocelus magnirostris Lafresnaye, Rev. and Mag. de Zoöl., 1853, p. 243.

Cotype.— No. 77,015, (♂); Lafresnaye Collection, no. 3,006; Trinidad.

Cotype.— No. 77,016, (♂); Lafresnaye Collection, no. 3,007; Trinidad.

† Ramphocelus aterrimus Lafresnaye

= Ramphocelus atrosericeus d'Orbigny and Lafresnaye

Ramphocelus aterrimus Lafresnaye, Rev. Zoöl., 1853, p. 244.

Type.— No. 77,012; Lafresnaye Collection, no. 3,015; "Bolivie Parzudaki."

Ramphocelus atro-sericeus d'Orbigny and Lafresnaye, Mag. Zoöl., 1837, p. 34.

After he described this supposed new form Lafresnaye soon discovered his mistake and wrote a second label for the type specimen, reading — "R. atro-sericeus, ♂, junior, d'Orb. synops., 34 et d'Orb. Voy., 280, pl. 26, 1."

† Ramphocelus varians Lafresnaye

= Ramphocelus icteronotus Bonaparte

Ramphocelus varians Lafresnaye, Rev. Zoöl., 1847, p. 216.

Type.— No. 77,296; Lafresnaye Collection, no. 3,025; "Andes de la Nlle. grenade."

Ramphocelus icteronotus Bonaparte, P. Z. S., 1837, p. 121.

Chapman (Bull. Am. Mus. N. H., **36**, 1917, p. 610) gives much thought to the distribution of the sulphur-rump, the red-rump and the orange-rump tanagers. He considers *R. flammigerus* and *T. icteronotus* distinct species, and believes *R. chrysonotus* to be a hybrid of these two.

Lafresnaye was puzzled by these closely allied forms, and although it was his intention to bestow the name *varians* upon the yellow, orange, and red-rumped birds indiscriminately, his description under "*R. varians* nob." applies particularly to the yellow-rumped bird which he calls his first variety, brought from Buenaventura by Delattre; therefore, M. C. Z. 77,296, Lafr. coll. 3,025, is the type. This is also the specimen which Lafresnaye described as "*R. icteronotus* . . . foemina aut junior" in his review of the varieties of *R. icteronotus* (cf. Rev. Zoöl., 1846, p. 361).

Of the orange-rumped bird, designated as the second variety, Lafresnaye had no specimens, but he was familiar with that form, having seen it together with yellow-rumped and red-rumped birds among the specimens in the Wilson Collection which had been turned over to him for examination (cf. Rev. Zoöl., 1846, p. 369). Afterward (Rev. Mag. Zoöl., 1853, p. 246) he named this orange-rumped bird *R. chrysonotus*, type locality Juntas, Bolivia, saying: "nous font également supposer que les individus à croupion orange que nous avons regardés comme troisième variété constitueront aussi une troisième éspèce que nous nommons *R. chrysonotus*." His allusion to a "troisième variété" is obviously a *lapsus calami* for "deuxième variété." The Wilson Collection, which contains the Delattre specimens, is now in the collection of the Academy of Natural Sciences of Philadelphia, where the specimen originally described as *R. varians* var. 2 (Rev. Zoöl., 1847, p. 217) and hence the type of *R. chrysonotus* Lafresnaye, should be found. Dr. Witmer Stone, who has very kindly sought out the specimens, finds one no. 7,513, marked "N. Grenada," which may possibly be the specimen in question.

The red-rumped bird which Lafresnaye designates as the third variety of *R. varians*, originally considered by him identical with *R. passerinii* Bonaparte (cf. Rev. Zoöl., 1846, p. 70), but which is really *R. flammigerus*, is represented in the Lafresnaye Collection by one adult male, M. C. Z. 77,168, Lafr. Coll. 3,022. This specimen is the subject of the description of *R. varians* var. 3.

Two other specimens in the Lafresnaye Collection are of interest in this connection:

1. M. C. Z. 77,169, Lafr Coll. 3,023, labelled — "R. varians, R. variable, 3^a var. ♀ nob. rev. 1847, 217 (Nlle. grenada Andes élevées Caly delatre) ♀, selon delatre." This is the bird described by Lafresnaye as a female, as the label indicated.

2. M. C. Z. 77,170, Lafr. Coll. 3,024, labelled — "R. varians, R. variable nob. rev. 1847, 217, 3^a var^{as} (junior) rev. 1846—365, Nlle. grenade Andes élevées Caly delatre." This is the specimen originally described by Lafresnaye as *R. icteronotus* jun. av. (Rev. Zoöl., 1846, p. 367).

Phlogothraupis sanguinolenta aprica Bangs

Phlogothraupis sanguinolenta aprica Bangs, Proc. New Eng. Zoöl. Club, **4**, 1908, p. 31.

Type.— No. 117,445, ♂; Costa Rica, Carrillo; 11 November, 1897; C. F. Underwood.

Piranga testacea desidiosa Bangs and Noble

Piranga testacea desidiosa Bangs and Noble, Auk, **35**, 1918, p. 461.

Type.— No. 123,477, ♂; Western Colombia, La Maria, Dagua Valley; 23 May, 1908; M. G. Palmer.

Piranga faceta Bangs

now Piranga testacea faceta Bangs

Piranga faceta Bangs, Proc. Biol. Soc. Washington, **12**, 1898, p. 141.

Type.— No. 105,452, ♂; Colombia, Santa Marta Mountains; 4 February, 1898; W. W. Brown.

Piranga hepatica dextra Bangs

Piranga hepatica dextra Bangs, Proc. Biol. Soc. Washington, **20**, 1907, p. 29.

Type.— No. 102,090, ♂; Mexico, Jalapa; 18 April, 1897; C. B. Isham.

Piranga roseogularis Cabot

now Piranga roseogularis roseogularis Cabot

Pyranga roseogularis Cabot, Proc. Soc. N. H., **2**, 1846, p. 187.

Type.— No. 72,518, ♂; Yucatan, on the road from Chemax to Yalahao; 5 April, 1842; S. Cabot.

† Piranga bivittata Lafresnaye

= Piranga leucoptera leucoptera Trudeau

Pyranga bivittata Lafresnaye, Rev. Zoöl., 1842, p. 70.

Type.— No. 76,991, (♂); Lafresnaye Collection, no. 3056; "Colombie ? Mexique."

Pyranga leucoptera Trudeau, Journ. Acad. Nat. Sci. Phila., **8**, 1839, p. 160.

At the time Lafresnaye described his *P. bivittata*, he had three specimens for all of which he wrote exactly similar labels. Two of these, no. 3,055, adult male and no. 3,057 adult female, prove to belong to the South American form — *P. leucoptera ardens* Tschudi, which in the adult male plumage lacks the black front; both probably come from Colombia. Had Lafresnaye's description applied to these two specimens his name would have antedated Tschudi's. It is perfectly clear, however, that he described from No. 3,056, a Mexican bird, as he distinctly says — "fronte . . . nigerrimis."

Piranga sanguinolenta Lafresnaye

now Piranga bidentata sanguinolenta Lafresnaye

Pyranga sanguinolenta Lafresnaye, Rev. Zoöl., 1839, p. 97.

Cotype.— (The female described), No. 77,038; Lafresnaye Collection, no. 3,054; "Mexique."

In the article cited above Lafresnaye described a number of new birds from the collection of Charles Brelay of Bordeaux. Brelay gave to Lafresnaye a number of specimens as told us by Lafresnaye himself, among these I feel certain were the types of *Dendrocolaptes affinis* and *Myadestes obscurus*, as well as the female cotype of the present species (Lafresnaye already had a male, and so probably wanted the female). For these three specimens Lafresnaye wrote labels, all similar, and of the sort he always wrote for his new birds, and I feel wholly justified in claiming the types.

The types of the other species described in this article must have remained in the Brelay cabinet; certain it is that they did not find their way into the Lafresnaye Collection.

Saltator rubicoides Lafresnaye

now Habia rubica rubicoides (Lafresnaye)

Saltator rubicoides Lafresnaye, Rev. Zoöl., 1844, p. 41.

Type.— No. 76,998 (adult ♂); Lafresnaye Collection, no. 3,068; "Mexique."

A second specimen, no. 3,069, is immature, with olive-green feathers scattered through its plumage, and is not a cotype. A third, no. 3,067, listed by Verreaux as *P. rubicoides*, was not named on its label by Lafresnaye, and proves to be *P. salvini salvini* Berlepsch.

Phoenicothraupis rubica confinis Bangs

now Habia rubica confinis (Bangs)

Phoenicothraupis rubica confinis Bangs, Proc. Biol. Soc. Washington, **18**, 1905, p. 156.

Type.— No. 110,034, ♂; Honduras, Yaruca; 25 February, 1902; W. W. Brown.

Lanio aurantius Lafresnaye

Lanio aurantius Lafresnaye, Rev. Zoöl., 1846, p. 204.

Type.— No. 77,004; Lafresnaye Collection, no. 3,078; "Colombie ou Am. centr."; (Guatemala substituted by Berlepsch).

The type is somewhat immature as stated by Lafresnaye in his original description. Another specimen, no. 3,077, a fully adult male, is, therefore, not a cotype.

Lanio leucothorax ictus Kennard and Peters

Lanio leucothorax ictus Kennard and Peters, Proc. New Eng. Zoöl. Club, **10**, 1927, p. 1.

Type.— No. 234,444, ♂; Panama, Boquete Trail, 2,300 feet altitude; 21 March, 1926; F. H. Kennard.

Tachyphonus brevipes Lafresnaye

now Tachyphonus surinamus brevipes Lafresnaye

Tachyphonus brevipes Lafresnaye, Rev. Zoöl., 1846, p. 206.

Cotype.— No. 76,728; Lafresnaye Collection, no. 3,100; "Colombie."
Cotype.— No. 76,729; Lafresnaye Collection, no. 3,101; "Colombie."

† Tachyphonus ruficeps Lafresnaye

= Thlypopsis fulviceps Cabanis

Tachyphonus ruficeps Lafresnaye, Rev. Zoöl., 1848, p. 173; (not of Strickland, Am. and Mag. N. H., **14**, 1844, p. 419).

Cotype.— No. 77,076; Lafresnaye Collection, no. 3,117; "Caracas, Venezuela."

Cotype.— No. 77,077; Lafresnaye Collection, no. 3,118; "Caracas, Venezuela."

Thlypopsis fulviceps Cabanis, Mus. Hein., **1**, 1851, p. 138.

Lafresnaye soon discovered that he had used a preoccupied name when he described this species, and wrote new labels for the two cotypes, so stating, and with a substitute MS. name which, however, he never published.

Tangara albocristata Lafresnaye

now Sericossypha albocristata (Lafresnaye)

Tangara (Lamprotes) albo-cristata Lafresnaye, Rev. Zoöl., 1843, p. 132; Mag. Zoöl., 1844, pl. 50.

Type.— No. 77,001; Lafresnaye Collection, no. 3,062; "Colombie."

† Tachyphonus albitempora Lafresnaye

= Chlorospingus ophthalmicus (Du Bus)

Tachyphonus albitempora Lafresnaye, Rev. Zoöl., 1848, p. 12.

Cotype.— No. 77,050; Lafresnaye Collection, no. 3,122; Bogotá (error = Mexico).

Cotype.— No. 77,051; Lafresnaye Collection, no. 3,123; "Colombie" (error = Mexico).

Arremon ophthalmicus Du Bus, Bull. Acad. Bruxelles, **14**, 1847, pt. 2, p. 106.

Verreaux listed as one of the types, no. 3,123, but Lafresnaye had not named this specimen, which is a female *Spindalis pretrei*. Lafresnaye, however, in his discussion, (Rev. Zoöl., 1848, p. 12) did mention a specimen, which he says had a smaller postauricular spot and brighter pectoral band, no. 3,127, M. C. Z. 77,064, which proves to be *Chlorospingus fulrigularis* Berlepsch of Bolivia. Lafresnaye had a MS. name for this form written on the label of the specimen, which he never published.

Chlorospingus novicius Bangs

now Chlorospingus novicius novicius Bangs

Chlorospingus novicius Bangs, Proc. New Eng. Zoöl. Club, **3**, 1902, p. 67.

Type.— No. 108,740, ♀; Panama, Volcan de Chiriqui; 15 February, 1901; W. W. Brown.

Chlorospingus regionalis Bangs

now Chlorospingus novicius regionalis Bangs

Chlorospingus regionalis Bangs, Proc. Biol. Soc. Washington, **19**, 1906, p. 112.

Type.— No. 117,491, ♂; Costa Rica, Cariblanco de Sarapiqui; 11 August, 1899; C. F. Underwood.

Arremon flavopectus Lafresnaye

now Chlorospingus flavopectus flavopectus (Lafresnaye)

Arremon flavo-pectus Lafresnaye, Rev. Zoöl., 1840, p. 227.

Type.— No. 77,066; Lafresnaye Collection, no. 3,125; "Santa Fé de Bogotá."

Tachyphonus canigularis Lafresnaye

now Chlorospingus canigularis canigularis (Lafresnaye)

Tachyphonus canigularis Lafresnaye, Rev. Zoöl., 1848, p. 11.

Type.— No. 77,065; Lafresnaye Collection, no. 3,126; "Colombie."

Arremon atropileus Lafresnaye

now Hemispingus atropileus atropileus (Lafresnaye)

Arremon atro-pileus Lafresnaye, Rev. Zoöl., 1842, p. 335.

Type.— No. 77,068; Lafresnaye Collection, no. 3,133; "Bogotá? Parzudaki."

Two other birds, much better specimens than the type, nos. 3,134 and 8,506, have very differently worded labels, and were obviously received by Lafresnaye at a later date.

Arremon superciliaris Lafresnaye

now Hemispingus superciliaris superciliaris (Lafresnaye)

Arremon superciliaris Lafresnaye, Rev. Zoöl., 1840, p. 227.

Type.— No. 77,073; Lafresnaye Collection, no. 3,130; "Santa Fé de Bogotá."

Lafresnaye had two additional specimens, neither of them cotypes, nos. 3,128 and 3,129, the latter in fact referable to *Hemispingus superciliaris nigrifrons* Lawrence.

Arremon rubrirostris Lafresnaye

now Cnemoscopus rubrirostris (Lafresnaye)

Arremon rubrirostris Lafresnaye, Rev. Zoöl., 1840, p. 227.

Cotype.— No. 77,071; Lafresnaye Collection, no. 3,131.
Cotype.— No. 77,072; Lafresnaye Collection, no. 3,132.

Nemosia verticalis Lafresnaye

now Pseudospingus verticalis (Lafresnaye)

Nemosia verticalis Lafresnaye, Rev. Zoöl., 1840, p. 227.

Type.— No. 77,080; Lafresnaye Collection, no. 3,136; Bogotá. A second specimen, no. 3,137, Lafresnaye Collection, is not a cotype.

PLOCEIDAE

Steganura aucupum nilotica Chapin

Steganura aucupum nilotica Chapin, American Museum Novitates, no. 43, 1922, p. 5.

Type.— No. 63,579, ♂; Blue Nile, 10 miles above Abuzor; 6 January 1913; G. M. Allen and J. C. Phillips.

Ploceus fringilloides Lafresnaye

now Amaurestes fringilloides (Lafresnaye)

Ploceus fringilloides Lafresnaye, Mag. Zoöl., 1835, pl. 48, text, plate.

Type.— No. 76,258; Lafresnaye Collection, no. 6,372; "de l'inde" (error = West Africa).

The type of this species was given Lafresnaye by Charles Brelay of Bordeaux of whom Lafresnaye says: "possesseur d'une belle collection ornithologique et qui a déjà eu l'extrême generosité de me céder quelques espèces interessantes comme celle-ci."

Hypargos nitidula virens Friedmann

Hypargos nitidula virens Friedmann, Proc. New Eng. Zoöl. Club, **10**, 1927, p. 6.

Type.— No. 237,508, [♂]; Tanganyika Territory, Amani, Usambara Mountains; 1 December, 1926; A. Loveridge.

Amadina fasciata candida Friedmann

Amadina fasciata candida Friedmann, Occ. Papers Bost. Soc. N. H., **5**, 1926, p. 218.

Type.— No. 232,923, ♂; Kenya Colony, Taveta; 4 April, 1925; H. Friedmann.

† Ploceus melanotis Lafresnaye

= Anaplectes leuconotus (Müller)

Ploceus melanotis Lafresnaye, Rev. Zoöl., 1839, p. 20 (not of Swainson, Birds of W. Afr., **1**, 1837, p. 307).

Cotype.— No. 76,257; Lafresnaye Collection, no. 6,238; "Senegal — abyssinie."

Cotype.— No. 76,258; Lafresnaye Collection, no. 6,239; "Senegal — abyssinie."

Ploceus leuconotus V. Müller, Naum., Heft 4, 1851, p. 28.

The plate in Magasin de Zoölogie (1839, pl. 7) was either very poorly colored or it has changed much, the red being much too dark and dull.

Reichenow (Vögel Afrikas, **3**, p. 26) uses Lafresnaye's name for this species, in spite of the fact that he was aware of Swainson's earlier use of *Ploceus melanotis* (cf. in synonymy of *Ploceus baglafecht* Vieill., p. 40).

† Ploceus melanotis Guérin

= Othyphantes baglafecht (Vieillot)

Ploceus melanotis Guérin, Rev. Zoöl., 1843, p. 321 (not of Swainson, Birds of W. Afr., 1837, **1**, p. 307, and not of Lafresnaye, Rev. Zoöl., 1839, p. 20).

Ploceus (Hyphantornis) Guerini Gray, Guérin and Lafresnaye, in Ferret and Galinier, Voy. en Abyssinie, p. 196, note, correction.

Ploceus baglafecht Vieillot, Nouv. Dict. Hist. Nat., **34**, 1819, p. 127.

Cotype.— No. 76,072; Lafresnaye Collection, no. 6,266; "Abyssinie."

Cotype.— No. 76,073; Lafresnaye Collection, no. 6,267; "Abyssinie."

Cotype.— No. 76,074; Lafresnaye Collection, no. 6,265; "Abyssinie."

Cotype.— No. 76,075; Lafresnaye Collection, no. 6,268; "Abyssinie."

Lafresnaye's no. 6,265 (M. C. Z., 76,074) is unquestionably the bird figured in the Atlas as it, of the two males, alone agrees with the plate, but as male, female and young were all mentioned in the original description, I am forced to regard all four specimens as cotypes.

Guérin and Lafresnaye suspected that their bird was the *Ploceus baglafecht* of Vieillot, but considered Vieillot's description unrecognizable.

Icteropsis pelzelni tuta Bangs and Phillips

Icteropsis pelzelni tuta Bangs and Phillips, Occ. Papers Bost. Soc. N. H., **5**, 1925, p. 177.

Type.— No. 65,370 ♂; Tanganyika Territory, Busisi, at south end of Victoria Nyanza; 1 October, 1890; Emin Pasha.

Xanthophilus bojeri alleni Mearns

Xanthophilus bojeri alleni Mearns, Smiths. Misc. Coll., **56**, no. 20, 1911, p. 6.

Type.— No. 56,117, ♂; Kenya Colony, Miru River; 13 August, 1909; G. M. Allen.

Spermospiza ruficapilla cana Friedmann

Spermospiza ruficapilla cana Friedmann, Proc. New Eng. Zoöl. Club, **10**, 1927, p. 7.

Type.— No. 237,509, ♂; Tanganyika Territory, Amani, Usambara Mountains; 26 November, 1926; A. Loveridge.

† Passer domesticus chephreni Phillips

= Passer domesticus alexandrinus Madarasz

Passer domesticus chephreni Phillips, Proc. Biol. Soc. Washington, **26**, 1913, p. 167.

Type.— No. 63,594, ♂; Egypt, Gizeh; 12 December, 1912; G. M. Allen and J. C. Phillips.

Passer alexandrinus Madarasz, Ann. Mus. Hungar., **9**, 1911, p. 340.

† Passer rutilans yunnanensis La Touche

= Passer rutilans intensior Rothschild

Passer rutilans yunnanensis La Touche, Bull. B. O. C., **43**, 1923, p. 150.

Cotype.— No. 125,973, ♂; Yunnan, Lotukow; 12 May, 1921; La Touche Collection.

Cotype.— No. 125,974, ♀; Yunnan, Milati; 10 February, 1921; La Touche Collection.

Passer rutilans intensior Rothschild, Bull. B. O. C., **43**, 1922, p. 11.

There is no question about La Touche's *yunnanensis*. It is a straight synonym of *intensior* of Rothschild. Personally, I should not have hesitated a moment in also relegating this latter name to the synonymy of *Passer rutilans cinnamomeus* Gould. I cannot distinguish our specimens, either males or females in any way, but Rothschild retains it in his latest list of Yunnan birds and Ticehurst (Jour. Bombay, N. H. Soc., Oct., 1927, p. 347) rather emphatically upholds it and I, therefore, suppose, in spite of our material, that *intensior* is really a good form.

ICTERIDAE

Ostinops viridis flavescens Bangs and Penard

Ostinops viridis flavescens Bangs and Penard

Ostinops viridis flavescens Bangs and Penard, Bull. Mus. Comp. Zoöl., **62**, 1918, p. 85.

Type.— No. 34,744, ♂; Peruvian Amazons, Xeberos; 16 June, 1866; Bartlett Collection.

Cassicus uropygialis Lafresnaye

now Cacicus uropygialis uropygialis (Lafresnaye)

Cassicus uropygialis Lafresnaye, Rev. Zoöl., 1843, p. 290.

Type.— No. 76,203; Lafresnaye Collection, no. 6,048; "Colomb. ou Nlle. grenade."

† Cassicus curvirostris Lafresnaye

= Cacicus uropygialis uropygialis (Lafresnaye)

Cassicus curvirostris Lafresnaye, Rev. Zoöl., 1847, p. 218.

Type.— No. 76,204; Lafresnaye Collection, no. 6,049; "Colombie."

Cassicus uropygialis Lafresnaye, Rev. Zoöl., 1843, p. 290.

The type is a bird with a slightly abnormal bill, which led Lafresnaye to describe it as a new species.

Psomocolax oryzivorus impacifus Peters

Psomocolax oryzivorus impacifus Peters, Proc. Biol. Soc. Washington, **42**, 1929, p. 123.

Type.— No. 102,320, ♂; Vera Cruz, Pasa Nueva; 22 April, 1901; A. E. Colburn and P. W. Shufeldt.

Cassidix oryzivora violea Bangs

now Psomocolax oryzivorus violeus (Bangs)

Cassidix oryzivora violea Bangs, Proc. New Eng. Zoöl. Club, **2**, 1900, p. 11.

Type.— No. 105,855, ♂; Colombia, Santa Marta Mountains, La Concepcion; 13 February, 1899; W. W. Brown.

† Icterus brevirostris d'Orbigny and Lafresnaye

= Molothrus rufoaxillaris Cassin

Icterus brevirostris d'Orbigny and Lafresnaye, Mag. Zoöl., 1838, cl. 2, pls. 77 to 79, syn., p. 7 (not *Molothrus brevirostris* Swainson, Anim. Menag., December, 1837, or January, 1838, p. 305).

Cotype.— No. 88,440; Lafresnaye Collection, no. 6,192; "Maldonado, Corrientes"; d'Orbigny.

Molothrus rufo-axillaris Cassin, Proc. Ac. Nat. Sci. Phila., 1866, pp. 14, 23.

Hellmayr considers this to be a cotype, but did not tell me, in this instance, how many others were in the Paris Musuem.

† icterus maxillaris d'Orbigny and Lafresnaye

= Molothrus bonariensis bonariensis (Gmelin)

Icterus maxillaris d'Orbigny and Lafresnaye, Mag. Zoöl., 1838, Syn. Av., p. 6.

Cotype.— No. 84,292; Lafresnaye Collection, no. 6,190; "Andes orientales"; d'Orbigny.

Tanagra bonariensis Gmelin, Syst. Nat., **1**, 1789, p. 898.

Our specimen, which Hellmayr considers a cotype, has the peculiar bill which led to the name given by d'Orbigny and Lafresnaye. Hellmayr informs me that there is another cotype in the Paris Museum.

Hellmayr, a year or two ago, told me he was inclined to recognize a Bolivian subspecies under the name *maxillaris*, but Friedmann (Auk, **44**, 1927, p. 500) does not consider the characters sufficiently well marked, and places *maxillaris* in the synonymy of *bonariensis*

Agelaius phoeniceus floridanus Maynard

Agelaius phoeniceus floridanus Maynard, Birds East North Am., 2nd ed., pt. 40, 1895, p. 698.

Cotype.— No. 13,963, ♂; Florida, Key West; December, 1870; C. J. Maynard.

Cotype.— No. 13,976, ♀; Florida, Key West; 19 November, 1870; C. J. Maynard.

Agelaius assimilis subniger Bangs

Agelaius assimilis subniger Bangs, Proc. New Eng. Zoöl. Club, **4**, 1913, p. 92.

Type.— No. 113,372, ♀; Isle of Pines, near Cuba, Cienaga; 24 April, 1904; W. R. Zappey.

Leistes superciliaris petilus Bangs

Leistes superciliaris petilus Bangs, Proc. Biol. Soc. Washington, **24**, 1911, p. 190.

Type.— No. 31,023, ♂; Argentina, Entre Rios, Concepcion del Uruguay; 27 November, 1880; W. B. Barrows.

Wetmore (Bull. U. S. Nat. Mus., no. 133, 1926, p. 375) does not recognize this form. It seems to me, however, that the southern subspecies is so much smaller, that for the present at least, I continue to recognize it.

Sturnella magna argutula Bangs

Sturnella magna argutula Bangs, Proc. New Eng. Zoöl. Club, **1**, 1899, p. 20.

Type.— No. 100,225, ♂; Florida, Dunedin; 3 March, 1883.

Sturnella magna paralios Bangs

Sturnella magna paralios Bangs, Proc. New Eng. Zoöl. Club, **2**, 1901, p. 55.

Type.— No. 106,954, ♂; Colombia, Santa Marta Mountains, San Sebastian; 25 July, 1899; W. W. Brown.

Icterus dominicensis portoricensis Bryant

now Icterus portoricensis Bryant

Icterus dominicensis var. *portoricensis* Bryant, Proc. Bost. Soc. N. H., **10**, 1866, p. 254.

Type.— No. 46,539, ♂; Porto Rico; Robert Swift.

† Icterus wagleri castaneopectus Brewster

= Icterus wagleri Sclater

Icterus wagleri castaneopectus Brewster, Auk, **5**, 1888, p. 91.

Type.— No. 214,131, ♂; Sonora, near Oposura; 13 April, 1887; John C. Cahoon.

Icterus wagleri Sclater, P. Z. S., 1857, p. 7.

Icterus cucullatus trochiloides Grinnell

Icterus cucullatus trochiloides Grinnell, Auk, **44**, 1927, p. 70.

Type.— No. 216,491, ♂; Lower California, Triumfo; 24 June, 1887; M. A. Frazar.

† Oriolus musicus Cabot

= Icterus mesomelas mesomelas (Wagler)

Oriolus musicus Cabot, Proc. Bost. Soc. N. H., **1**, 1843, p. 155.

Cotype.— No. 72,515; "Ticul and Macoba," Yucatan; S. Cabot.
Cotype.— No. 88,804; "Ticul and Macoba," Yucatan; S. Cabot.
Cotype.— No. 88,805; "Ticul and Macoba," Yucatan; S. Cabot.

Psarocolius mesomelas Wagler, Isis, 1819, p. 155.

Some time after I wrote a list of the Cabot types (Auk, **32**, 1915, p. 166), the other two specimens of this Icterus, that Cabot said he secured in Yucatan, turned up together with other Cabot Yucatan birds. These were all mounted by Dr. Cabot himself, and had been kept in an old-fashioned glass case in his house. We suspected the existence of these specimens, but could never verify it until after many inquiries. The case was finally presented to the Museum after having been discovered and secured by Mrs. Henry Lyman, one of Dr. Cabot's descendants.

Icterus xanthornus helioeides Clark

now Icterus nigrogularis helioeides Clark

Icterus xanthornus helioeides Clark, Auk, **19**, 1902, p. 265.

Type.— No. 102,690, ♂; Venezuela, Margarita Island; 11 July, 1901; A. H. Clark.

† Icterus guttulatus Lafresnaye

= Icterus pectoralis pectoralis (Wagler)

Icterus guttulatus Lafresnaye, Mag. Zoöl., 1844, pl. 52.

Type.— No. 76,120; Lafresnaye Collection, no. 6,129; "Mexique."

Psarocolius pectoralis Wagler, Isis, 1829, p. 755.

Quiscalus atroviolaceus d'Orbigny

now Ptiloxena atroviolaceus (d'Orbigny)

Quiscalus atroviolaceus d'Orbigny, in La Sagra, Hist. Nat. Cuba, Ois., 1839, p. 121, pl. 19.

Type.— No. 84,595; Lafresnaye Collection, no. 6,206; Cuba.

The Lafresnaye label for this specimen reads "quiscalus atro-violaceus nob. Cuba la Sagra."

In the work cited above d'Orbigny described as new nine species. Of these we have in the Lafresnaye Collection the undoubted types of five, as shown by Lafresnaye's written labels. d'Orbigny several times refers to birds in the Lafresnaye Collection, and makes generous acknowledgment to Lafresnaye for assistance rendered him by that distinguished ornithologist.

Holoquiscalus jamaicensis bangsi Peters

Holoquiscalus jamaicensis bangsi Peters, Auk, **38**, 1921, p. 442.

Type.— No. 68,025, ♂; Cayman Brac Island; 28 June, 1911; W. W. Brown.

Holoquiscalus lugubris contrusus Peters

Holoquiscalus lugubris contrusus Peters, Occ. Papers Bost. Soc. N. H., **5**, 1925, p. 175.

Type.— No. 99,986, ♀; Lesser Antilles, St. Vincent, Bonhomme Mountains; 26 February, 1925; J. L. Peters.

Holoquiscalus dispar Clark

now Holoquiscalus fortirostris dispar Clark

Holoquiscalus dispar Clark, Proc. Biol. Soc. Washington, **18**, 1905, p. 61.

Type.— No. 112,802, ♀; Lesser Antilles, St. Vincent; Kingstown; 31 October, 1903; A. H. Clark.

Quiscalus subalaris Boissonneau

now Macragelaeus subalaris (Boissonneau)

Quiscalus subalaris Boissonneau, Rev. Zoöl., 1840, p. 70.

Type.— No. 76,093; Lafresnaye Collection, no. 6,207; "Sta fé de Bogotá."

EULABETIDAE

† Lamprotornis fusca Peale

= Aplonis tabuensis (Gmelin)

Lamprotornis ? fusca Peale, U. S. Expl. Exped., 1848, p. 110.

Cotype.— No. 75,739, ♂; Tongataboo; T. R. Peale.

Lanius tabuensis Gmelin, Syst. Nat., **1**, 1788, p. 306.

Peale did not state how many specimens he secured of this species.

Lamprotornis brevirostris Peale

now Aplonis brevirostris (Peale)

Lamprotornis brevirostris Peale, U. S. Expl. Exped., 1848, p. 111.

Cotype.— No. 75,740, ♀; Samoan Islands; T. R. Peale.

Again Peale did not mention the number of specimens taken, saying only that the species was obtained at the Samoan Islands, where it is not common.

Lamprotornis atrifusca Peale

now Aplonis atrifusca (Peale)

Lamprotornis atrifusca Peale, U. S. Expl. Exped., 1848, p. 109.

Cotype.— No. 75,738; Samoan Islands; T. R. Peale.

Another species, of which Peale gives no inkling of the number taken by him.

Aplonis panayensis suggrandis Bangs and Peters

Aplonis panayensis suggrandis Bangs and Peters, Occ. Papers Bost. Soc. N. H. **5**, 1927, p. 241.

Type.— No. 235,888, ♂; Maratua Island (off east coast of Borneo); March, 1926; E. Mjöberg.

† Scissirostrum pagei Lafresnaye

= Scissirostrum dubium (Latham)

Scissirostrum Pagei Lafresnaye, Rev. Zoöl., 1845, p. 93.

Type.— No. 76,249; Lafresnaye Collection, no. 6,024; "Manado celebes, rap. p. Leclanches exped. de la favorite, Capne Page."

Lanius dubius Latham, Ind. Orn., Suppl. 1801, p. 18.

Lafresnaye had another specimen which he received later, and properly identified as *dubium* of Latham, which, of course, is not a cotype.

ORIOLIDAE

Oriolus xanthonotus persuasus Bangs

Oriolus xanthonotus persuasus Bangs, Bull. Mus. Comp. Zoöl., **45**, 1922, p. 83.

Type.— No. 64,180, ♂; Palawan Island, Puerto Princesa; 14 August, 1913; W. Cameron Forbes.

DICRURIDAE

Buchanga leucogenys cerussata Bangs and Phillips

now Dicrurus leucogenys cerussatus (Bangs and Phillips)

Buchanga leucogenys cerussata Bangs and Phillips, Bull. Mus. Comp. Zoöl., **58**, 1914, p. 302.

Type.— No. 50,235, ♂; Hupeh, Ichanghsien; 9 June, 1907; W. R. Zappey.

Edolius forficatus potior Bangs and Penard

Edolius forficatus potior Bangs and Penard, Proc. New Eng. Zoöl. Club, **8**, 1922, p. 25.

Type.— No. 232,371; Anjouan Island.

CORVIDAE

Corvus coronoides mengtszensis La Touche

Corvus coronoides mengtszensis La Touche, Bull. B. O. C., **43**, 1922, p. 80.

Cotype.— No. 125,016, ♂; Yunnan, Mengtsz; 31 January, 1921; La Touche Collection.

Cotype.— No. 125,017, ♀; Yunnan, Mengtsz; 27 January, 1921; La Touche Collection.

Corvus corone yunnanensis La Touche

Corvus corone yunnanensis La Touche, Bull. B. O. C., **43**, 1922, p. 43.

Cotype.— No. 125,003, ♀; Yunnan, Mengtsz; 26 October, 1920. La Touche Collection.

Cotype.— No. 125,004, ♂; Yunnan, Mengtsz; 2 March, 1921; La Touche Collection.

Corvus imparatus Peters

Corvus imparatus Peters, Proc. Biol. Soc. Washington, **42**, 1929, p. 123.

Type.— No. 49,840, ♂; Tamaulipas, Rio La Cruz; 24 June, 1909; F. B. Armstrong.

Nucifraga hemispila macella Thayer and Bangs

now Nucifraga caryocatactes macella Thayer and Bangs

Nucifraga hemispila macella Thayer and Bangs, Bull. Mus. Comp. Zoöl., **52**, 1909, p. 140.

Type.— No. 50,012, ♂; Hupeh, Hsienshanhsien; 11 December, 1907. W. R. Zappey.

Calocitta formosa pompata Bangs

Calocitta formosa pompata Bangs, Proc. New Eng. Zoöl. Club, **4**, 1914, p. 102.

Type.— No. 121,098, ♂; Costa Rica, Bolson; 19 December, 1907; C. F. Underwood.

† Garrulus glandarius diaphorus La Touche

= Garrulus glandarius pekingensis Reichenow

Garralus glandarius diaphorus La Touche, Bull. B. O. C., **35**, 1915, p. 98.

Type.— No. 125,130, ♂; N. E. Chihli; January, 1915; La Touche Collection.

Garrulus bispecularis pekingensis Reichenow, J. f. O., 1905, p. 425.

Boanerges internigrans Thayer and Bangs

Boanerges internigrans Thayer and Bangs, Mem. Mus. Comp. Zoöl., **40**, 1912, p. 200.

Type.— No. 52,587, ♂; Szechuan, Shoo-o-Lo; 23 August, 1908; W. R. Zappey.

Perisoreus infaustus opicus Bangs

Perisoreus infaustus opicus Bangs, Bull. Mus. Comp. Zoöl., **54**, 1913, p. 474.

Type.— No. 57,701, ♂; Altai Mountains, Topucha; 8 August, 1912; N. Hollister.

PERISOREUS BARBOURI W. S. Brooks

now PERISOREUS CANADENSIS BARBOURI W. S. Brooks

Perisoreus barbouri W. S. Brooks, Proc. New Eng. Zoöl. Club, **7**, 1920, p. 49.

Type.— No. 82,105, ♂; Anticosti Island, Ellis Bay; 8 September, 1919; W. S. Brooks.

This is an interesting island form, in some characters intermediate between *P. c. canadensis* and *P. c. nigricapillus*, but purer grayish above than either.

PERISOREUS CANADENSIS ALBESCENS Peters

Perisoreus canadensis albescens Peters, Proc. New Eng. Zoöl. Club, **7**, 1920, p. 51.

Type.— No. 247,526, ♂; Alberta, Red Deer; 18 March, 1897; G. F. Dippie.

CYANOCITTA CRISTATA FLORINCOLA Coues

Cyanocitta cristata florincola Coues, Key, N. Am. Birds, 2d ed., 1884, p. 421.

Neotype.— No. 5,190, ♂; Florida, Hibernia; 3 February, 1869; J. A. Allen and J. Marcy.

The type is marked, "Selected as the type by Wm. Brewster at request of Dr. Coues, March 9, 1898."

The Blue Jay in eastern North America shows such a gradual change from a northern to a southern subspecies that it is much a matter of individual opinion where the line between the two should be drawn. Having gone over a large and complete series, I prefer to leave the question as Ridgway had it, in Birds of North and Middle America, rather than follow Oberholser (Auk, **38**, 1921, p. 83).

PICA SANBLASIANA Lafresnaye

now CISSILOPHA SANBLASIANA SANBLASIANA (Lafresnaye)

Pica San-Blasiana Lafresnaye, Mag. Zoöl., 1842, Ois., pl. 28.

Type.— No. 76,202; Lafresnaye Collection, no. 5,543; (Acapulco, cf. Bangs and Penard, *infra*).

Penard and I have already shown that Lafresnaye's type represents the southern form and came from Acapulco, as stated by Lafresnaye himself. We were, therefore, forced to name the northern form.

Cissilopha sanblasiana nelsoni Bangs and Penard

Cissilophea sanblasiana nelsoni Bangs and Penard, Bull. Mus. Comp. Zoöl., **63**, 1919, p. 40.

Type.— No. 65,111, ♂; Colima, Colima; 7 May, 1913; Gustav Gluckert.

Cyanolyca blandita Bangs

now Cyanolyca argentigula blandita Bangs

Cyanolyca blandita Bangs, Proc. Biol. Soc. Washington, **19**, 1906, p. 109.

Type.— No. 109,324, ♂; Panama, Volcan de Chiriqui; 2 June, 1901; W. W. Brown.

Although a very distinct form the Volcan de Chiriqui jay is a representative of *C. argentigula* of the Volcan de Irazú, and, therefore, best treated as a subspecies.

Corvus vociferus Cabot

now Psilorhinus mexicanus vociferus (Cabot)

Corvus vociferus Cabot, Boston Journal of N. H., **4**, 1844, p. 464.

Cotype.— No. 74,746; Yucatan; S. Cabot.

Cotype.— No. 74,747; Yucatan; S. Cabot.

Shortly after I published a list of the Cabot types, the two missing specimens of this bird turned up. They had been mounted and were packed away in a box, perhaps to be discarded. Fortunately, they still had the Cabot numbers attached to their legs. The third cotype — Cabot said he took three examples — is preserved in the collection of the Academy of Natural Sciences of Philadelphia.

Psilorhinus mexicanus captus Kennard and Peters

Psilorhinus mexicanus captus Kennard and Peters, Proc. New Eng. Zoöl. Club,, **10**, 1927, p. 2.

Type.— No. 234,483, ♂; Panama, Chiriquicito; 25 March, 1926; F. H. Kennard.

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RECONNAISSANCE OF THE WATERS AND PLANKTON OF MONTEREY BAY, JULY, 1928

By Henry B. Bigelow and Maurine Leslie

CAMBRIDGE, MASS., U. S. A.
PRINTED FOR THE MUSEUM.
May, 1930

PUBLICATIONS

OF THE

MUSEUM OF COMPARATIVE ZOÖLOGY

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No. 5.— *Reconnaissance of the Waters and Plankton of Monterey Bay, July, 1928*

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I. Introduction

The study of the physical and chemical character of the water, and of the plankton of Monterey Bay, described in the following pages, was carried out jointly by members of the Hopkins Marine Station of Stanford University, the Museum of Comparative Zoölogy, the Scripps Institution of Oceanography; and by the California Division of Fish and Game, which made the field work possible by placing at our disposal their patrol boats "Steelhead" and "Albacore."

In this presentation of the general results, our thanks are due to Prof. W. E. Allen for counts and specific determinations of diatoms; Dr. Albert Mann, specific determinations of diatoms; Dr. Tage Skogsberg, determinations of peridinians; to the Scripps Institution for allowing the use of much unpublished data on physics and chemistry of California waters; to Miss Alice Beale, Miss Mary Sears and Mr. C. V. MacCoy for identification of plankton (p. 541). Acknowledgments are also due to the U. S. Bureau of Fisheries, and to the

Scripps Institution for the loan of apparatus. We wish also to express our gratitude to Mr. E. C. Scofield of the Division of Fish and Game for his constant supervision of, and assistance in the boat work; also to Capt. Walter Engelke, and to the crew of the "Albacore," without whose friendly coöperation nothing could have been done.

The equipment consisted of a handwinch, with steel wire, suitable for work to 600 meters, the usual water bottles, deep sea thermometers, and open tow nets.

Determinations of salinity, phosphates, silicates and nitrates were carried out (by Leslie) in the laboratory of the Hopkins Station. The chemical methods are described below.

Counts of diatoms were made at the Scripps Institution.

Thirty-one stations were occupied in various parts of the bay and in its offing, between June 30 and July 24, the results of which are tabulated below (p. 567).

II. Methods and Standards of Accuracy

The observational error for temperature (with the instruments employed) is about $\pm 0.15°$ for the surface, 0.1° for the subsurface readings.

Salinities were determined by the titration method developed by the Conseil Permanent International pour l'Exploration de la Mer. The method is now in general use and is accurate to ± 0.03 ‰.

Dissolved oxygen was determined by the Winkler method as described by Jacobsen (1921) and the percentage saturation was computed from the table given by him.[1] By means of a tube attached to the stopcock of the Ekman bottle, the water for the oxygen determination was drawn directly into the sample bottle. The latter was allowed to fill and overflow until it had been thoroughly rinsed of air-contaminated water. Reagents were added immediately and the samples kept in the dark until they were titrated the following day. The experimental error is 0.05 cc. per liter.

Silicate was determined by the Diénert and Wandenbulcke (1923) method as modified by Atkins (1923a). No correction for salt error was made. King and Lucas (1928) have recently pointed out that the concentration recommended by Atkins for the picric acid solution (used as an artificial standard in the silica test) was too great. Com-

[1] The values for 100% saturation given in this table are slightly lower than those found in Harvey (1928) and American Public Health Association (1917) but Jacobsen's table is based on the Winkler method and hence should be used here. See also Jacobsen (1905).

parison of our standards with corresponding ones prepared according to King and Lucas gives a factor of 1.33 by which our values should be multiplied to make them strictly correct. For comparison with the work which has already been done by others on the basis of the old standards we leave our data as originally determined. According to Atkins the figures in the second decimal place are of uncertain significance.

Estimation of phosphate was carried out by the method of Denigès (1920, 1921) as described by Atkins (1923). As Atkins and Wilson (1927) have pointed out, this method is also sensitive to arsenates so that these values represent any arsenate present as well as phosphate. Atkins claims an accuracy of ± 0.001 milligram per liter.

The water samples for phosphate and silicate determinations were analyzed the afternoon of the day they were collected, except one series which was analyzed the following day.

Exceptionally high values of phosphate and silicate were found at stations 25 and 26. Investigation revealed that ordinary plankton bottles with cork stoppers had been used as containers for these two series of samples. Tests with distilled water confirmed our suspicion that phosphate and silicate were dissolved from either the cork or the glass, so the chemical data from these two stations were rejected. The citrate of magnesia bottles used as containers for the samples at all other stations were well seasoned and we have no reason to doubt the reliability of these results.

The method developed by Harvey (1926, 1928a) with the changes described by Moberg (1929) was used for nitrate. A great deal of difficulty was experienced in preparing a suitable reagent and only a limited quantity was finally available. Most of the samples stood from two days to three weeks before being determined. This and the fact that some difficulty was experienced with the colorimeter leave the nitrate values open to some question. However since they give a general idea of the state prevailing at that time, we include them.[1]

[1] For an excellent discussion of methods for the determination of phosphates and nitrogenous compounds in sea water, and for some technical improvements, see Rapports et Procès-Verbaux des Reunions, Cons. Internat. Explor. Mer., **53**, 1929.

III. Topography

Since the oceanographic character of any coastal sector is largely determined by its submarine topography and by the trend of the coast line, we may point out that Monterey Bay is a shallow bight, some twenty miles across its mouth from headland to headland, by about eleven miles deep (Fig. 1). Off the southern headland (the Monterey

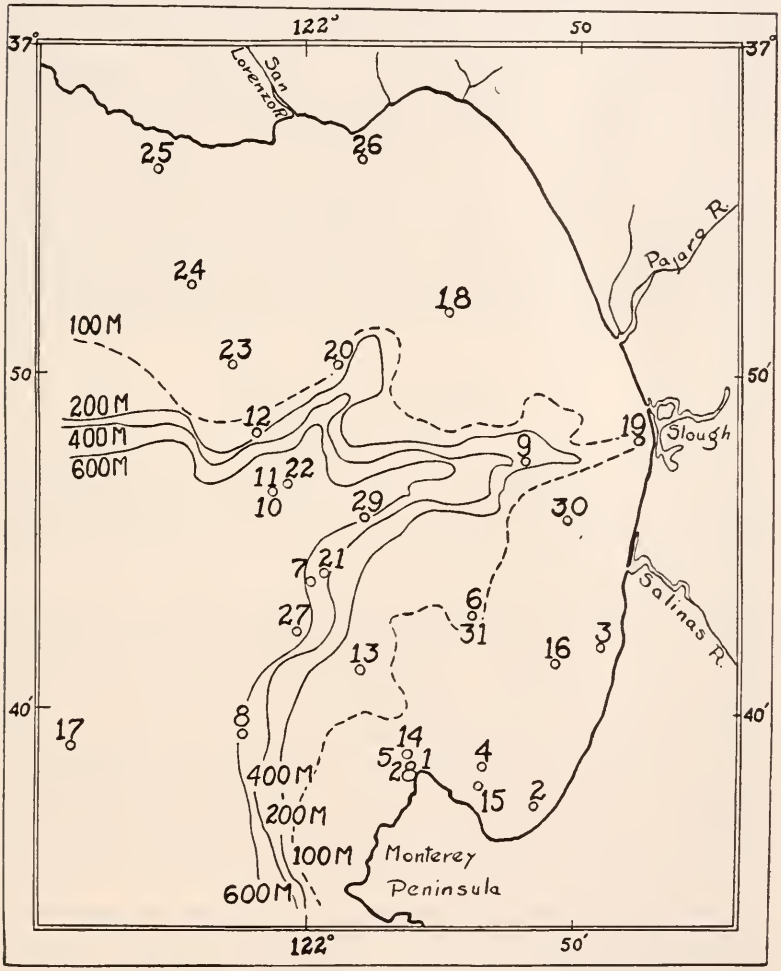

Fig. 1.— Chart of Monterey Bay, showing locations of stations, and bottom contours for depths of 100, 200, 400 and 600 meters.

peninsula), the 200 meter contour — generally taken as marking the edge of the continent — is within $1\frac{1}{2}$ miles of the shore at the nearest point, but lies some $8\frac{1}{2}$ miles out, abreast the northern boundary of the bay. Here, as along the coast of California in general, the slope is steep down to great depths, with 3,000 meters only some 35–45 miles out. The submarine topography of the bay itself is characterized by the existence of a deep, open, submerged valley, extending inward across the bay, a valley often spoken of as the submerged valley of the Salinas River [we express no view as to the geologic implication] because, so far as the general topography of the region is concerned, it seems a submarine continuation of that general drainage system.

At the mouth of the bay this trough is about 1,000 meters deep and about 5 miles broad between the 200 meter contours, narrowing to less than a mile in breadth and shoaling to about 200 meters, at a point about two miles off shore. Its slopes, as indicated on the contour chart (Fig. 1), are much steeper than the slope of the shoaler bottom, either to the north of it, or to the south. Thus any profile of the bay running north and south crosses this deep trough about midway.

IV. Physical Oceanography

A. Temperature

It is now so thoroughly established that the low temperatures of the surface waters along the coast of southern and central California are due to upwelling of colder water from below that no defense of this thesis is required.

In a region of this sort the thermal state prevailing at any given season is instructive chiefly (a) as it affects the environmental character of the region from the biological standpoint and (b) as an expression of the activity with which upwelling has been taking place for some time previous, and of its regional localization.

The first of these requirements demands statement of the prevailing state, especially of the absolute values as well as of the amplitude of variation, at different localities, seasons and depths, as defining the conditions under which the animals and plants of the region actually live, and the fluctuations that they must either endure or in some way be able to escape, as by emigration.

The physical problem involves analysis of the regional variations as associated with other physical and chemical features of the water, also with the topography of the bottom. In the following account these two lines of approach are followed successively.

1. *Midsummer state as illustrated by July, 1928*

Surface

During July, 1928 the extreme recorded range of surface temperature for Monterey Bay (Fig. 2) was from 12.4° to 15.8°, the water

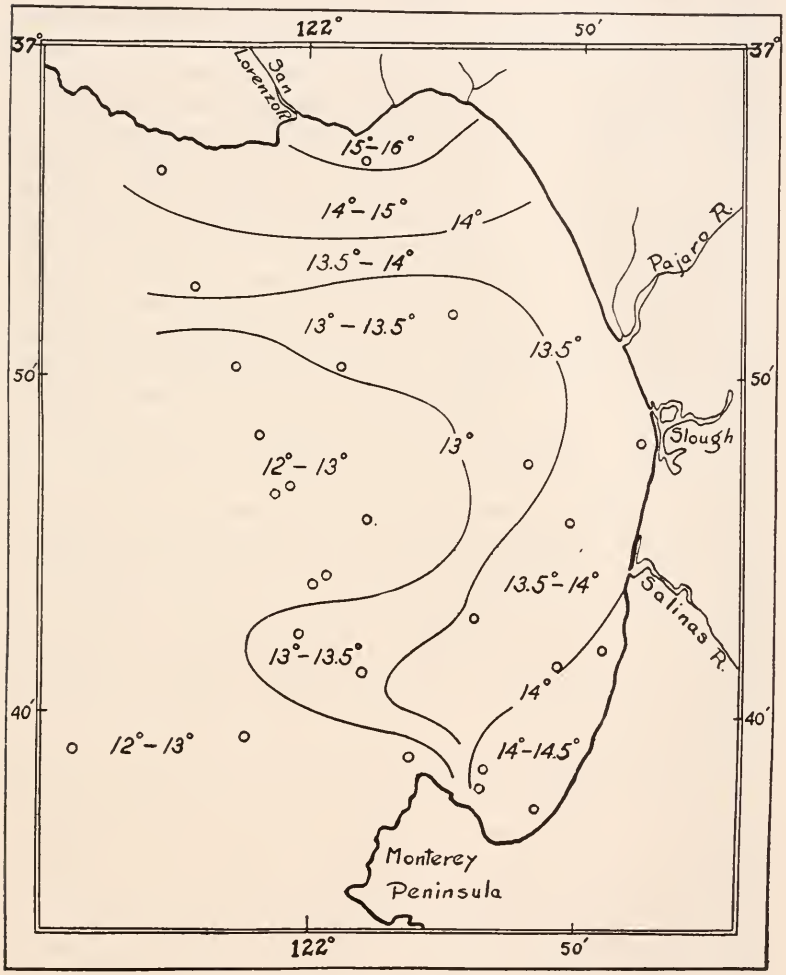

Fig. 2.— Surface temperature, July 1–24, 1928.

averaging coolest (12.4°–13.1°) over the mouth of the deep submarine cañon that gives the bay its distinctive character. Relatively low readings were also recorded close to the shore of Point Pinos at the southern portal to the bay, where local upwellings or turbulence maintained values close to 13° throughout the month as illustrated by the following succession: June 30 (Sta. 1), 13.3°; July 5 (Sta. 5), 12.1°; July 16 (Sta. 14), 12.8°; July 23 (Sta. 28), 12.4°. The warmest surface water (warmer than 14°) was localized (and by local report usually is localized in summer) in the two bights in the southeastern and northeastern parts of the bay, where protection from wave action, combined with shoalness of the water, not only favors heating of the surface by solar radiation *in situ*, but allows the warm surface stratum to accumulate as it is driven inshore by the sea breeze that develops by day along this sector of the coast at this time of year. In fact, local topography would have suggested as much.

It is not unlikely that somewhat higher values than those actually recorded would have been found had we paid more attention to these localities, particularly if we had taken more readings close in to the mouth of the San Lorenzo River. But it seems established, by our own records as well as by local report, that it is only in these sheltered parts of the bay that the surface may be expected to warm above 14° before August. Apparently these warm pools did not connect with each other along the eastern shore at the time.

Fractional differences recorded from day to day at given localities, resulting from disturbances of the water, combined with the general progress of seasonal warming, make it difficult precisely to locate the surface isotherms, from data extending over a period as short as was that covered by our investigations. At the mouth of the bay, for instance, the surface was 13.1° at Station 10 on July 13, but only 12.5° at the same location on the 21st (Sta. 22). The chart of surface temperatures (Fig. 2) is, therefore, only a generalization of the prevalent state for the month.

The mean surface temperature of the bay for July, 1928 was close to 13.4°; the maximum deviation from this mean was 2.4°, or only about 1° if the three warmest stations (temperatures of 15.8°, 14.9°, and 14.9°) be omitted from the calculation. And when it is recalled that these readings extend over a period of three weeks, that they cover an area of about two hundred square miles, and that they were taken at various stages of the tide, sometimes on a rough day, sometimes a smooth, some in fog, others in bright sunlight, and at different times of day, great regional uniformity is evidently characteristic of

Monterey Bay. This, in fact, applies to the whole Californian coast sector, as contrasted with the wide regional variations that prevail along the Atlantic coast of North America at corresponding latitudes.

Subsurface

At the season of our investigation Monterey waters cool comparatively slowly from the surface downward, as might have been expected. This vertical cooling, illustrated by curves for representative stations (Figs. 3 and 4), was, as a rule, most abrupt in the upper 25 meters. At some stations the rate of vertical change was nearly uniform throughout this depth-stratum, at others most rapid between 10 or 15 meters and 25; at others, again, the uppermost stratum (5–10 meters) was more nearly homogeneous as to temperature, while at still other stations a homogeneous layer was recorded at 5–15 meters depth. Station to station differences such as these, in the uppermost 15 meters, no doubt reflect the temporary or local effects of tidal movements, or of the stirring by the waves. But our studies were not sufficiently detailed for analysis of the factors that controlled in any one instance.

On the average the decrease in temperature, with depth from the surface downward to the 25 meter level, amounted in July, 1928 to about 3.3°, the mean temperature at the 25 meter level being 10.1°, the extreme values at that depth 9.1°–11.7°, or omitting the one warmest station (located at the head of the trough close to land) 9.1°–10.9°.

Projection of the 25 meter temperature (Fig. 5), shows a reversal as compared with the surface in the relative locations of the warmest and coldest water at the time, the former being concentrated over the submarine trough at the 25 meter level, instead of over the shoal parts of the bay; especially notable is the accumulation of warm water right up to the head of the trough. This phenomenon, discussed below (page 471), is more clearly demonstrated by a profile (Fig. 6) running out from the coastline at Moss Landing along the axis of the trough, which shows all the successive isotherms as dipping sharply toward the land at all depths from 10 meters down to about 50.

On the average, cooling with depth was considerably less rapid from the 25 meter level downward than above that level, but continued at a nearly uniform rate down to the greatest depth from which we obtained data. Thus an increase in depth from 25 meters to 50 meters corresponded during the period to an average chilling by about 0.7°, the average value at 50 meters (19 stations) being 9.4°. It is also worth noting that the temperature was more nearly uniform regionally (con-

sidering the area included) at about 50 meters than at any other level down to considerably greater depths, with an extreme range of only from 9.1° to 10.1°.

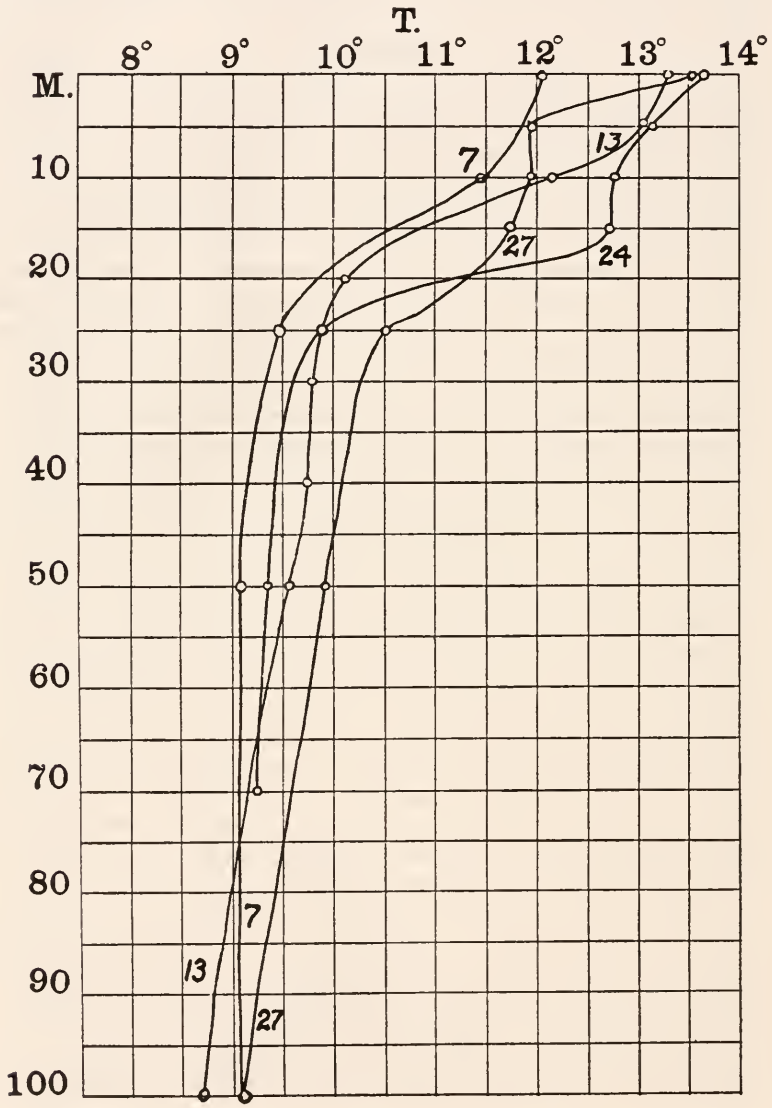

Fig. 3.— Vertical distribution of temperature at representative stations 7, 13, 24, 27) in the upper 100 meters.

Owing to this regional uniformity, projection of the values at the 50 meter level would of itself throw little light on the loci of most active upwelling, for although the isotherm for 9.5° divided the area, into a cooler northern and offshore part and a warmer belt around the

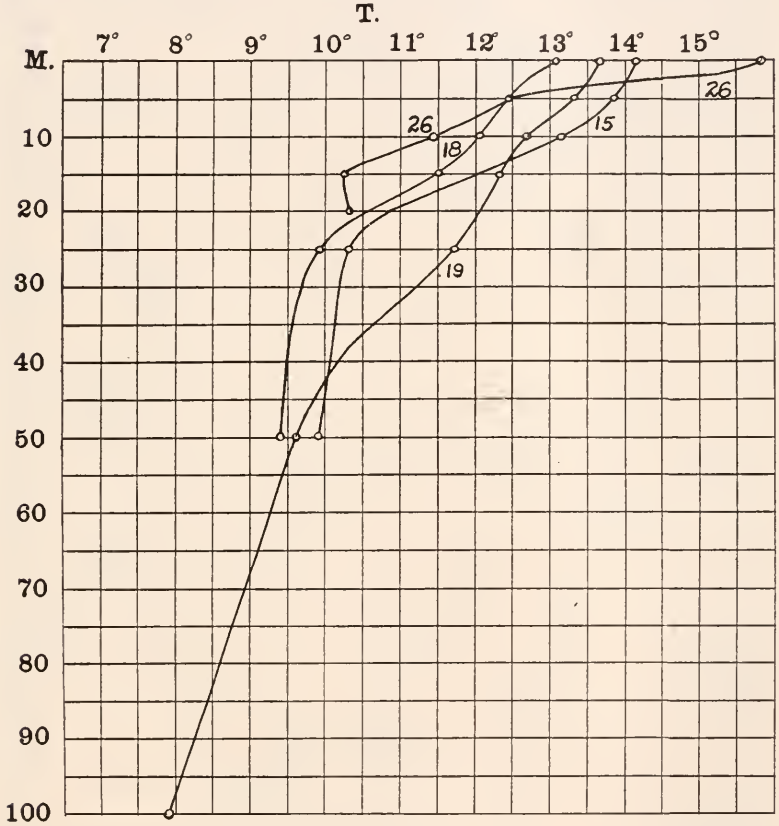

FIG. 4.— Vertical distribution of temperature at successive stations around the shore of the bay (15, 18, 19, 26).

western and southern margin at this level, the difference in the recorded values was so small from station to station, and the observations extended over so long a period of time that they do not give a just idea of the spacial distribution of temperature at this general level. In this case other types of projection are needed. Thus a profile

crossing the mouth of the bay from north to south (Fig. 7), for the period July 13–23, shows that within the stratum between the 50 meter and 100 meter levels the successive isotherms for 9° and 9.5°, running

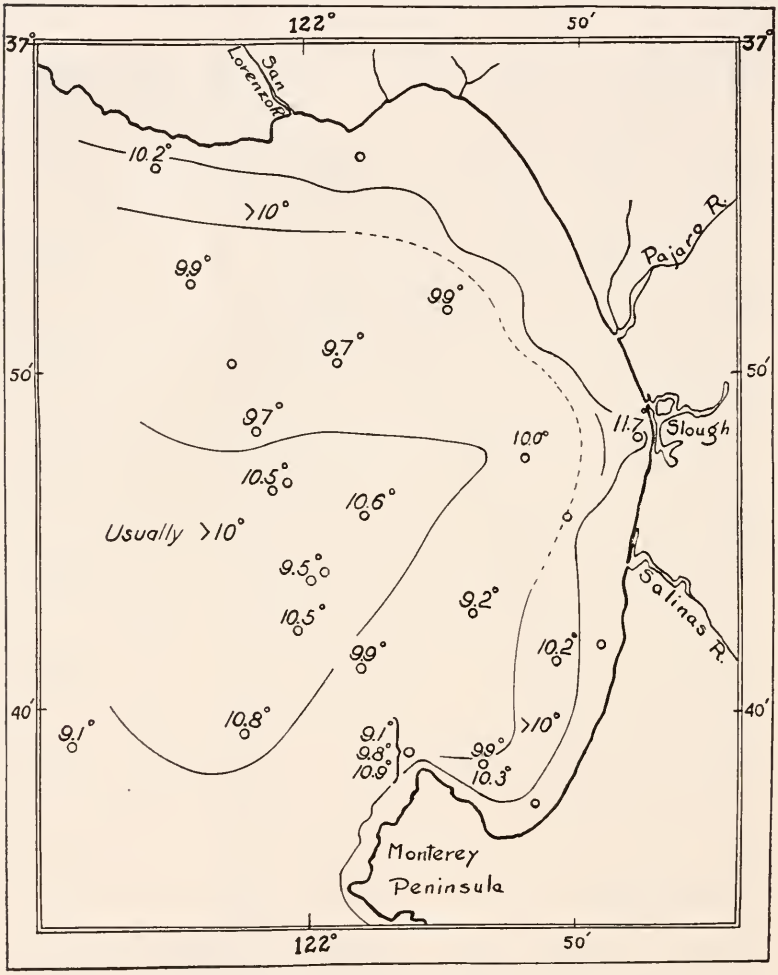

Fig. 5.— Temperature at a depth of 25 meters, July 1–24, 1928.

level across the northern half of the bay, dipped abruptly into the axis of the trough. Had the profile been run a week earlier, when upwelling was more active, as shown by the closer approach of cold

(<9.5°) water to the surface in the trough (Sta. 7), the distribution would have been essentially the same, with the successive isotherms rising closer to the surface over the southern slope (Sta. 7) than in the deep axis (Sta. 10).

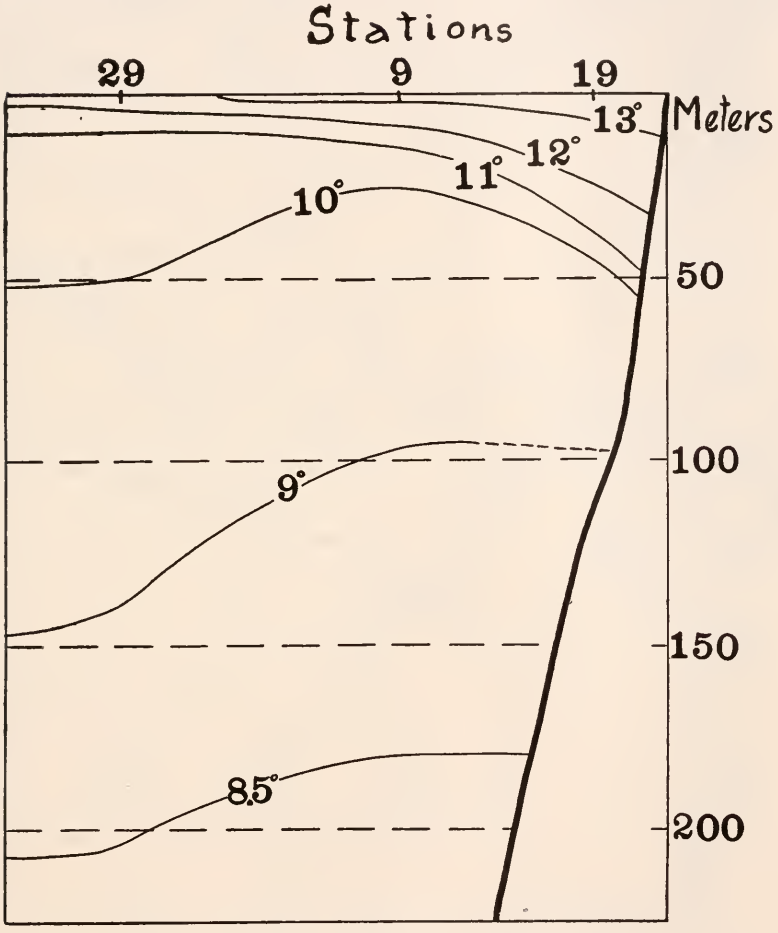

FIG. 6.— Temperature profile, running offshore from Moss Landing, July 12–24.

The average thermal difference between the 50 meter level and the 100 meter level (about 0.6°) was only about one seventh as great as the difference recorded in the equally thick stratum of water from the

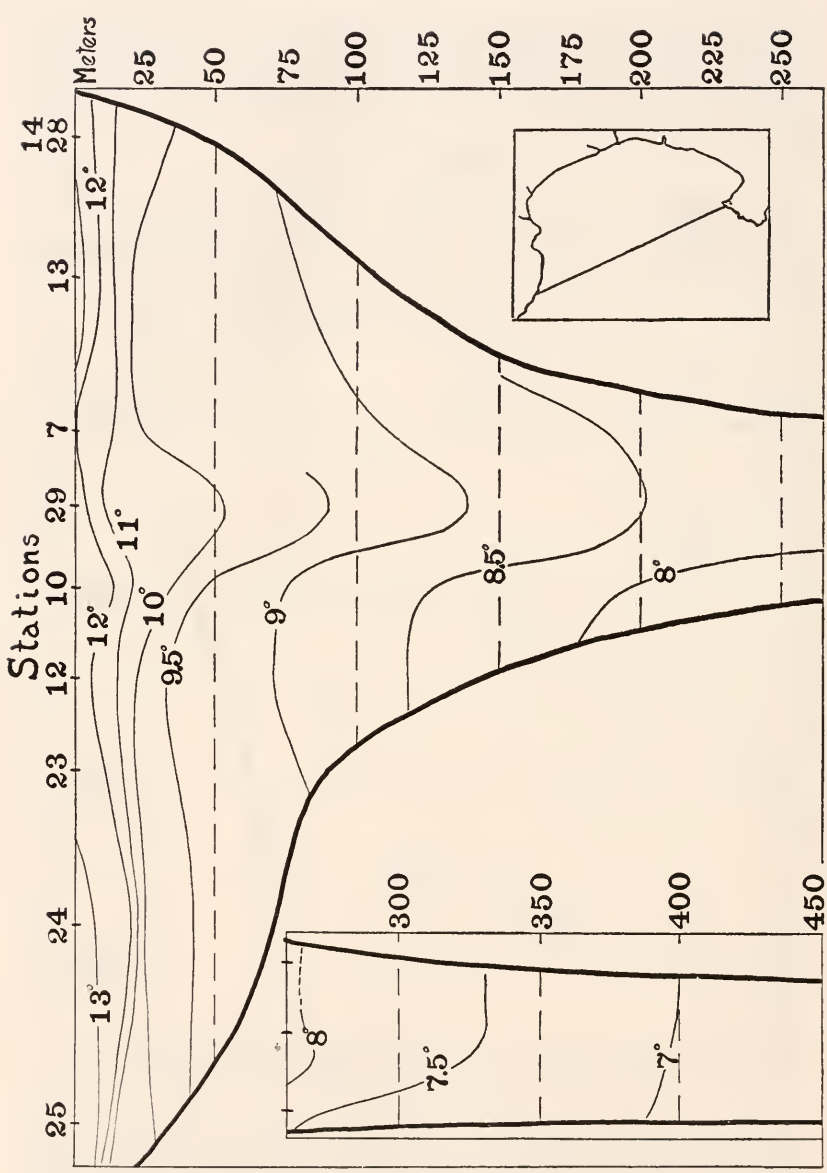

FIG. 7.— Temperature profile crossing the mouth of the bay, July 10–24.

surface downward to 50 meters (4°). The mean value (nine stations) at 100 meters was about 8.8°. But in spite of the contraction of the area at increasing depths, caused by the converging slopes of the submarine

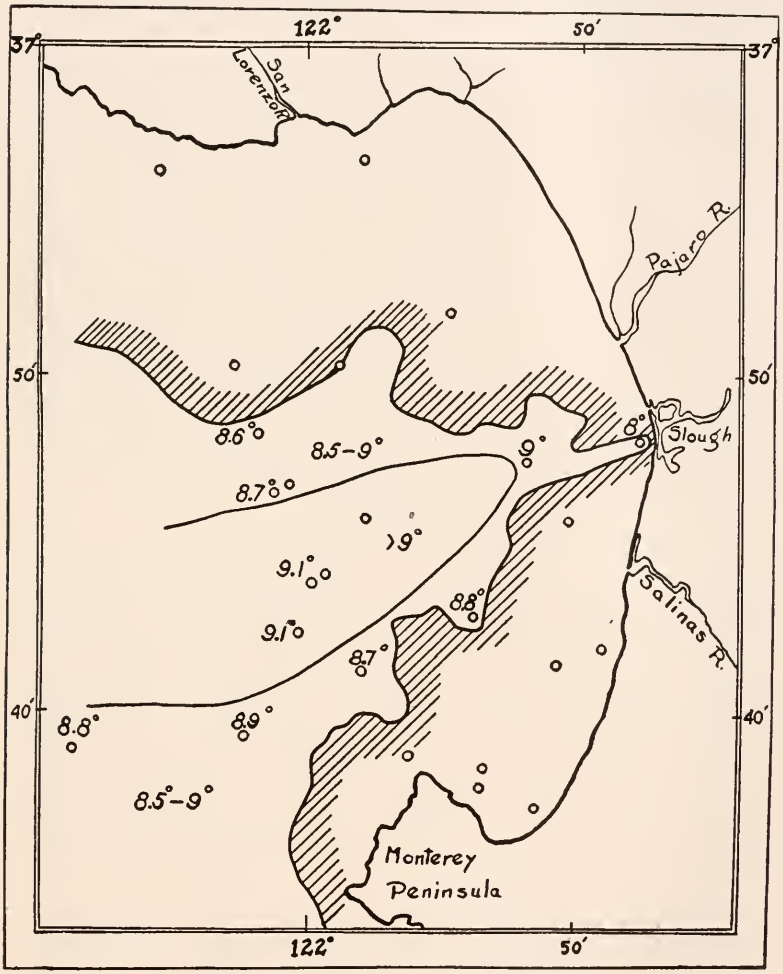

Fig. 8.— Temperature at a depth of 100 meters.

valley, the extreme recorded temperatures were farther apart at 100 meters (7.9°-9.4°) than at 50 meters. Furthermore, horizontal projection of the 100 meter isotherms (Fig. 8) including all the stations,

irrespective of date, shows definite localization of the warmest water (>9°) over the axis of the trough, and of colder (<9°) water over its slopes, as already noted for the profile (Fig. 7). The isotherms for 9° and 9.5° also show localization of the updraft of cold water chiefly on the northern side.

Our records for temperature at depths greater than 100 meters are confined to the trough, and to the continental slope off the Monterey peninsula to the south. Within the former, our stations show a banking up of the coldest water against the northern slope (Fig. 7) down to at least 150 meters as illustrated by the isotherm for 8°. But the extreme thermal range recorded at 200 meters (7 stations) was only about 0.4° (8.2°–8.6°), while at 400 meters 3 stations in the trough (10, 27, 29) gave almost precisely the same value (6.9°–7°) as did two stations off the open slope (8 and 17, 6.85° and 6.95°) although the observations covered an interval of twelve days. And regional uniformity in temperature is apparently characteristic of this part of the slope, for it prevailed down to 600 meters (our deepest observations), where readings at two stations in the trough, as well as at one off Point Pinos, were respectively 5.4°, 5.6° and 5.5°, with the curves of vertical distribution for two other stations (8 and 29) suggesting about this same value at that depth (Fig. 9).

It is, of course, desirable to establish whether an average temperature close to 5.5° is typical of the 600 meter level across the Monterey front, not only in other seasons, but from summer to summer, or whether the state prevailing in July, 1928 represents any considerable departure from the normal one way or the other. Unfortunately no recent serial observations as deep as this are available for comparison for considerable distances to the north, to the south, or offshore from Monterey Bay. Neither did the "Albatross" take bottom readings at the 600 meter depth during her dredging campaigns in the bay in 1890, 1891, or 1897 (Townsend, 1901). But graphs constructed from her bottom readings in shoaler and deeper water suggest a mean 600 meter value close 5.6° C.; which corresponds almost exactly with the "Albacore" values of 1928.

In 1873 the "Tuscarora" made several serial determinations of temperatures off the Monterey peninsula which suggest a temperature about 1° lower (mean, 4.8°C.) than either the "Albatross" or "Albacore" values. But for instrumental reasons (page 466) it is not possible to judge how closely comparable these early observations are with the more recent ones.

2. *Seasonal variation*

It is not possible to reconstruct the normal seasonal variation of temperature below the surface of Monterey Bay from the few scattered bottom readings taken prior to the "Albacore" investigation.

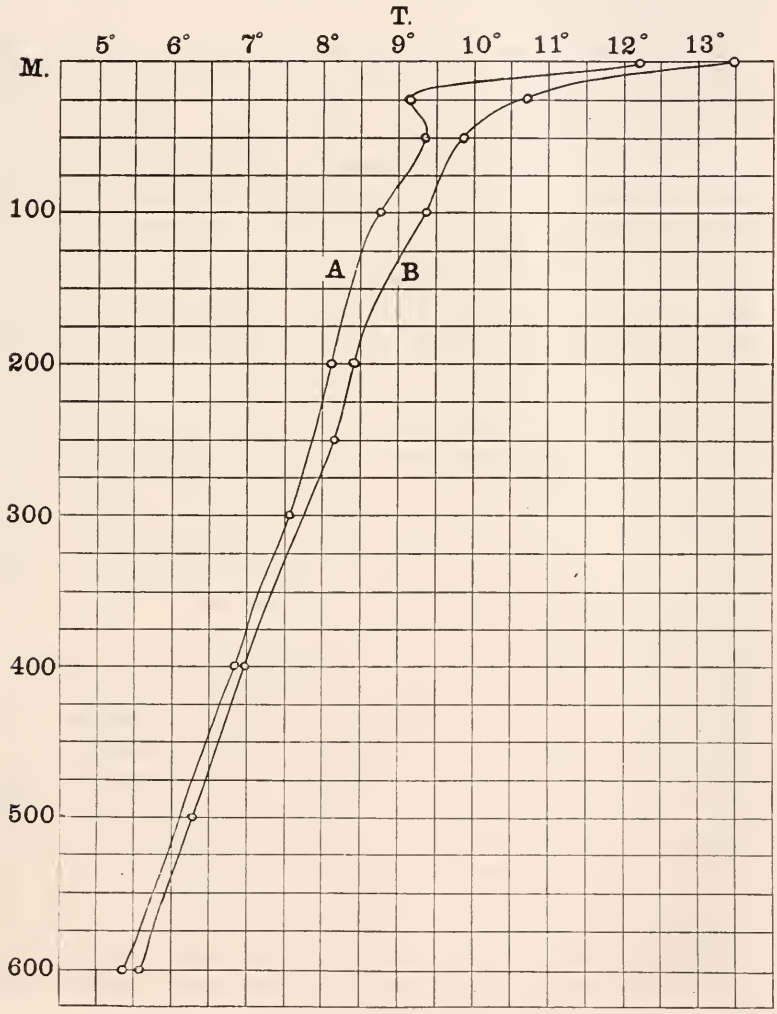

FIG. 9.— Maximum (B) and minimum (A) temperatures, surface to 600 meters, at Stations 8, 10, 17, 27 and 29.

But daily readings (Fig. 10) taken at the Hopkins Marine Station at Pacific Grove, on the south shore of the bay, during the years 1919-27 (Dorman, 1927a; Hubbs and Schultz, 1929), afford a good picture of the seasonal range of surface temperature at this inshore location [1] with some indication of the annual fluctuations that have taken place there, within that period.

It is, of course, a matter of deduction how closely readings for this locality, subject to all the disturbing effects of the coastline, can be accepted as typical of the bay as a whole. In July, 1928 the weekly averages there were 13.5°, 12.6°, 12.7° and 12.4°; contrasting with our readings of 14.2° and 14.9° about a mile offshore on the 3d (Sta. 4) and 17th (Sta. 15), and with a general average of 13-14° for that side of the bay for the month. This suggests that fractionally lower readings may be expected close to the tide line than out in the bay, in summer, as was to be expected from the stirring effect of the tide. But the difference is not great enough to rob the laboratory data of their illustrative value for the bay as a whole, with the important proviso that these inshore temperatures may show day to day and week to week fluctuations that do not parallel the surface temperature variations out over deeper water. Such a difference is, of course, to be expected, as is the case along almost any coastline where in- and offshore movements of the warmest surface stratum, caused by wind or tide, alternately bring relatively high temperatures close into the beach, or cause somewhat cooler water to well up from below when the warm stratum shifts out from the tide line. Bathers are perfectly familiar with this phenomenon wherever the surface is appreciably warmer than the underlying water in summer.

In regions where the range of temperature from winter to summer is wide, as it is around the coastline of the northern North Atlantic, day to day fluctuations of this sort usually are narrow, as compared with the seasonal progression, as illustrated, for instance, by the temperature graphs that have been published for Woods Hole (Sumner, Osburn, and Cole, 1913; Fish, 1925). But in regions such as Monterey Bay, where the seasonal swing is small, it is not surprising to find the week to week variations, caused by local events, exceeding the mean seasonal deviation for the year. In the year 1927, for example, the temperature at the Hopkins laboratory rose by about 3.5° during the month of October (fortieth to forty-fifth week); then fell again by about 2.5° within the next four weeks; while in 1919 an equally abrupt decline

[1] These readings were taken in a sheltered cove within a few yards of the shore, in water less than three feet deep.

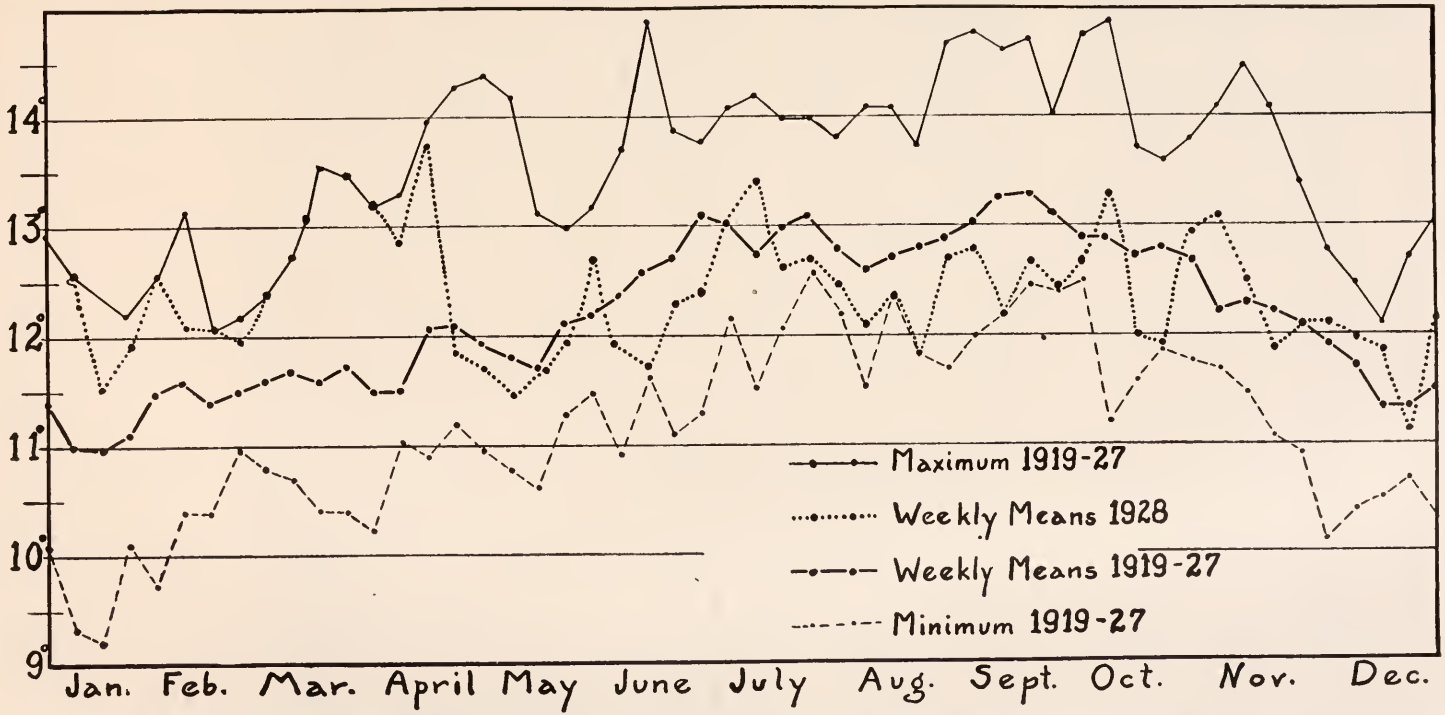

FIG. 10.— Seasonal progression of surface temperature at Hopkins Marine Station; light curve, maximum weekly means 1919–1927; broken curve, minimum weekly means; heavy curve, average weekly means for the period; dotted curve, weekly means for the year 1928.

of 1.8° was reported from the fortieth to the forty-sixth week, followed by almost as abrupt a recovery, although the mean annual range for the whole nine year series is only about 2.5°. The year 1928 again showed a sudden cooling by about 2° during April (Fig. 10), from the fifteenth week to the seventeenth, although gradual warming is the normal event at that season. Furthermore, there is no apparent consistency from year to year in the ups and downs, the curves for the several years crossing and recrossing one another as is better shown on the graph (Fig. 10) than verbally. Dorman (1927a, p. 85, Fig. 3) has already illustrated these sudden shifts of temperature for the 1923 series at Pacific Grove, and similar events are no less characteristic for the vicinity of La Jolla,[1] hence they are evidently characteristic for the coastline of southern and central California as a whole.

But in spite of the abrupt peaks and valleys that would characterize temperature graphs for the individual years, and in spite of the relatively considerable differences from year to year, in the values for given weeks, the trends for all but one of the years are roughly parallel (Fig. 10). And since this series covers nine consecutive years, the average thermal succession illustrated, namely coldest (averaging close to or slightly above 11° in late December and in January, warming progressively to an average maximum of about 13.5° in August and early September, to cool again at about the same rate throughout the autumn, may be accepted as characteristic.

The normal annual range for Monterey Bay is thus only about 2.5°, the extreme range that appears in the seven year series of weekly averages was about 5.6° (Fig. 10). The maximum deviation recorded in any one week of the series is 3.9°. Although deviations of 2° or more, within a single week, may be expected at any season of the year, having been recorded in every month except March, they have occurred most frequently in April, May, June, and July, when a total of twenty-seven such events has been recorded, contrasted with fourteen instances for other times of year. They are thus most frequent during the season of vernal warming, and when the temperature of the surface water is at its maximum, i.e., when the vertical gradient of temperature is steepest, as was to be expected if our explanation of their origin as due to local updrafts or churnings be correct.

At La Jolla, about 3° 45′ of latitude to the south, records taken by the Scripps Institution at their pier show the surface averaging coldest somewhat later in the winter (January and February), warmest some-

[1] See, for example, Allen, 1927, p. 35.

what earlier (July and August), and with a wider annual range (about 10°).

With respect to the annual range of surface temperature, the Monterey sector (like other similar areas in mid- or high latitudes where mass upwelling prevails) is the antithesis of waters at corresponding latitudes off coasts where the continental shelf is wide, and where the geographic situation is such that the interplay between local solar warming and winter chilling chiefly controls the thermal complex. Compare the seasonal curve for Pacific Grove with parts of the Gulf of Maine, for example, or with the southern side of the Gulf of St. Lawrence where the average range of surface temperature is close to 20°.

3. *Year to year variations*

The graph (Fig. 10) shows that the deviation in surface temperature from the mean over a term of years at Pacific Grove averages about 1° in each direction. During the period of record the greatest weekly deviation, above and below the mean, has been about 2°. And since no extraordinarily cold or extraordinarily warm years fell within the nine year period, even for the surface waters, it is evident that such events very seldom chance in this locality, if ever.

Hubbs and Schultz (1929) have already pointed out that 1926 was an abnormally warm year from January to May, but slightly colder than normal from June to November. The year 1928 was of this same type (Fig. 10), the weekly means averaging about 0.5° above normal during January, February and March. From mid-April until about mid-July, 1928, can be described as a normal year, with some of the weekly means falling above, others below the average curve. During August and September the means for 1928 averaged about 0.5° low, but these again rose fractionally above normal during the late autumn. Deviations of this sort, and at these particular times of year, make 1928 notable, among the years of record, by a seasonal trend more nearly horizontal than usual, for the spread between the maximum and minimum weekly means for that year (about 2.6°) is considerably less than in several of the other years of record (about 4° in 1920), with the highest and lowest points of a smoothed curve for the year 1928 only about 1° apart, contrasting with the usual range of 2.5°. Furthermore the regular seasonal progression exhibited by the records for all the other years (p. 448) was hardly apparent for 1928, when the mean temperature for winter and early spring was

about as high as the midsummer mean, instead of something like 2° lower as is the usual case, and with the water coldest in late spring when in most years vernal warming takes place.

4. *Comparison with southern California waters*

The contrast between the seasonal trend of surface temperature at Monterey, and in the offing of La Jolla, has already been referred to (p. 448). In summer McEwen's graphs (1916, pl. 34, 36) show the water in the vicinity of the Coronado Islands averaging about 7° warmer than Monterey Bay at the surface. If the subsurface temperature for July, 1928, can be taken as representative, the more southern locality is 2°–3° warmer at 50 meters, about 1.5° warmer at 100 meters, 1° warmer at 200 meters, fractionally warmer at 400 meters and at 600 meters. But temperatures recorded by the U. S. S. "Albatross" [1] at stations off Lower California, and off Santa Barbara in October, 1916 at 600 meters (5.7°, 5.75° and 5.6°), agree almost exactly with the 600 meter readings off Monterey Bay in July, 1928. No comparison is yet possible for other times of year, lacking subsurface data for Monterey Bay for any month except July, or for any other year.

B. Salinity

1. *Surface*

Midsummer, 1928

The surface waters of Monterey Bay were characterized in July, 1928, by remarkable uniformity in salinity, regionally considered, the maximum range recorded at that level being only .11 ‰ as shown in the following table of maximum, minimum, and mean values for different levels.

Depth Meters	Maximum	Minimum	Mean	Spread	No. of Stations	No. of Stations falling within ±.02[2] of the mean value	Mean Increase with depth
Surf	33.91	33.80	33.87	.11	26	19	
							.01
25	33.98	33.73	33.88	.25	20	11	
							.07
50	34.11	33.89	33.95	.22	18	11	
							.05
100	34.04	33.96	34.00	.08	10	3	
							.07
200	34.11	34.04	34.07	.07	5	4[3]	
							.13
400	34.22[3]	34.18	34.20	.04	4	3	
							.09
600	34.29	34.29	34.29	0	3	3	

[1] From data compiled by S. W. Chambers, 1929.

[2] This deviation is chosen because corresponding to the probable error of chlorine titration.

[3] Two stations by direct observations; two by interpolation.

The station to station differences are so small (when the experimental error of ±.02 is taken into account) that no definite subdivision of the surface into salter and fresher regions could be definitely established at the time, the recorded values being slightly higher at some stations, slightly lower at others near by, as would naturally be expected to result from wave action, tidal movements, etc. As further illustration of this regional uniformity, we need only point out that a profile from the southern headland of the bay to the northern (Fig. 15) shows no definite succession at the surface, most of the recorded values being almost precisely identical, while on lines from Monterey Harbor out to the continental slope the surface readings at six stations (2, 4, 8, 15, 17, 28) were precisely alike (allowing for the probable error), i.e., 33.86–33.89‰, though covering an interval of twenty-three days.

Even within a mile or so of the coastline, the surface water was not measurably fresher than in the central parts of the bay, while water samples taken daily at the landing of the Hopkins Marine Station show that this generalization can be extended right in to the tide line at this time of year, at least for this side of the bay. Thus at the time of our offshore investigations, the weekly means at the Hopkins Marine Station were 34‰, 33.93‰, 33.93‰, 33.86‰, giving an average for the month of about 33.92‰, corresponding closely with the average (33.87‰) just stated for the bay as a whole. The slightly higher mean for the first week of the period (34‰) probably reflected some local and temporary updraft over this sloping beach.

But the weekly averages at the Hopkins station, computed from readings taken there since 1919, show that much more violent fluctuations in the state of the water take place there within periods of a few days, than we encountered anywhere in the open bay during the whole month of July, 1928. The weekly variations for the month of July are as follows:

Year	Range	Year	Range	Year	Range
1919	.08‰	1922	.18‰	1925	.10‰
1920	.19‰	1923	.17‰	1926	.06‰
1921	.11‰	1924	.11‰	1927	.12‰

This considerable range of variability in the inshore waters for the month of July does not, however, reflect any prevailing increase or decrease throughout the month, the trend being practically horizontal at this time of the year as described below (p. 452).

Sporadic alterations of this sort are to be expected in the salinity

of the water close to the coastline, in any region where the column is characterized farther offshore by an increase or by a decrease in salinity, with depth. They are evidence of movements of the surface water in- and offshore, with corresponding updrafts from below, just as are the corresponding short-time alterations in surface temperature (p. 446). In the summer season it should be easier to correlate these local alterations with their causes (winds, tides, etc.) in regions like Monterey Bay where land drainage and rainfall are both negligible for a considerable portion of the year, than it is along coastlines where rivers discharge at all seasons, and where rainfall is more evenly distributed. In the former case vertical displacements chiefly need be taken into account; in the latter horizontal as well.

Seasonal variation at the surface

The uniformity that characterized the surface salinity, not only over the bay as a whole but also at the Hopkins Station, throughout July, 1928, together with other evidence shortly to be mentioned, shows that this is a season when the trend of surface salinity is practically horizontal; hence the "Albacore" observations throw no light on seasonal variation. For this we must turn to the daily readings that have been taken at the Hopkins Marine Station since 1919, just mentioned. And although the day to day, and week to week fluctuations are considerable there for salinity just as they are for temperature (p. 446), the fact that the mean value for the four weeks of July, 1928 (33.92‰) was almost precisely the same there as at our stations farther out justifies acceptance of the general seasonal trend of salinity at the Hopkins Station as representative of the bay as a whole.

Weekly averages at the station show a regular seasonal progression, with the surface averaging least saline from mid-February to mid-April (about 33.2–33.3‰), increasing comparatively abruptly in salinity through May and early June to a maximum (average about 33.7‰) which, in most years, was reached about the middle of that month. Little change then takes place through July and August, after which the salinity decreases slowly and at a comparatively constant rate throughout the autumn and early winter (Fig. 11).

On the whole, this seasonal progression corresponds to the seasonal distribution of the discharge from the Salinas River, most of which is condensed in the months of November, December, January, and February, according to the following measurements taken near its

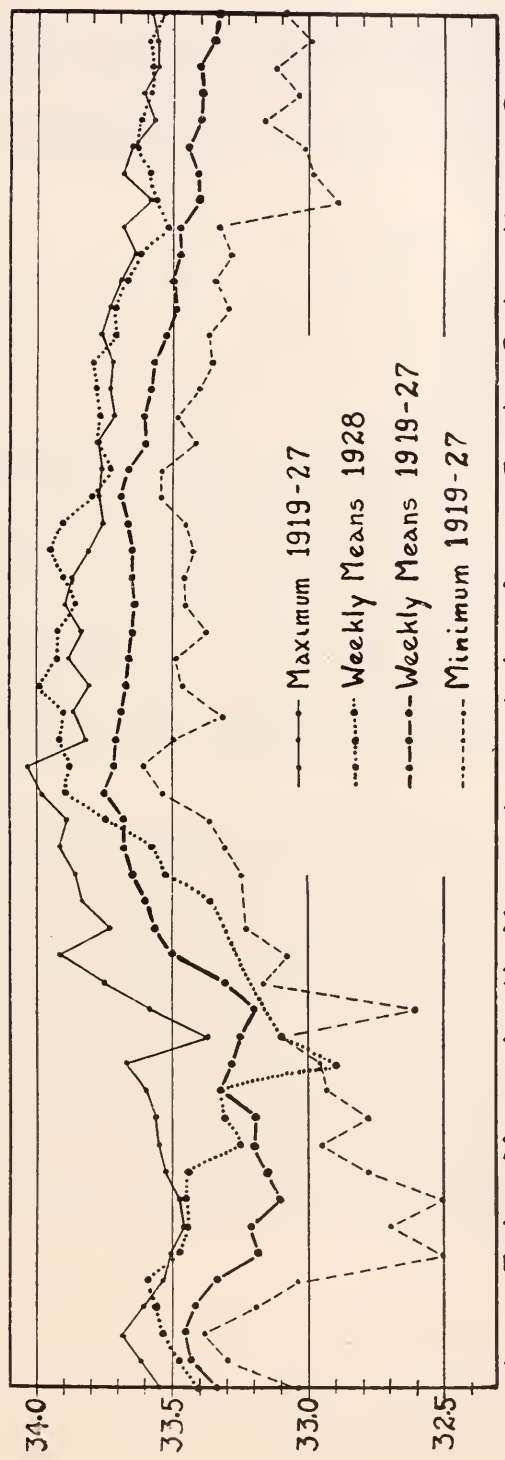

FIG. 11.—Seasonal progression of salinity at the Hopkins Marine Station; light curve, maximum weekly means, 1919–1927; broken curve, minimum weekly means; heavy curve, average weekly means; dotted curve, weekly means for the year 1928.

mouth by the U. S. Geological Survey in 1900 (Hamlin, 1904, Van Winkle and Eaton, 1910).[1]

Month	Mean discharge
January	848 ft. per second
February	105
March	73
April	22
May	17
June	16
July	8
August	7
September	6
October	2
November	2,413
December	295

The decrease that takes place in the salinity of the bay during the autumn and early winter probably reflects this local source. An increase, which seems a normal event because something of the sort took place in seven of the nine years of record, is shown from the first to the third week of January. Active upwelling at the time, interrupting the progressive incorporation of land water, would effect an alteration of this sort. And comparison with the corresponding weekly averages of temperature suggests this as its cause, because in six of the seven years it was accompanied by a fall in temperature, such as would result from an updraft in a region where the surface does not normally chill to the temperature of the underlying water even at the coldest season.

One other feature of the seasonal progression of salinity remains to be mentioned, namely, much greater variability from week to week during the half of the year when salinity is near its minimum than during the period of maximum salinity (Fig. 11). No doubt when the surface is flooded with land water the vertical gradient of salinity is considerably steeper than it is in summer. In this case that any displacement of the water in and out from the shore, or any churning by storm winds, would be much more clearly reflected along the shore by an alteration in the salinity than is the case when the whole column of water so affected is more nearly homogeneous vertically. The ups and downs that would be recorded on the curve for any one individual

[1] No data as to the volume of flow are available for the other rivers tributary to Monterey Bay, but as this reflects the seasonal distribution of rainfall in the mountains, probably it agrees with that of the Salinas River.

year (Fig. 11) may thus be interpreted as reflecting, in a sense, the incorporation into the general mass of the land water and of rainfall. The more completely has this incorporation taken place, the more nearly uniform from day to day may we expect to find the salinity of the water as it flows in and out over the beach.

2. *Subsurface, July, 1928*

When the vertical distribution of salinity is plotted for our stations it is at once apparent that while in every case the water was considerably more saline at 50 meters or deeper than at the surface the distribution in the uppermost stratum was of two different types. At most of the stations either the uppermost 25 meters was close to homogeneous as to salinity, or a slight increase of salinity was recorded from the surface downward. But four stations in the central part of the bay showed an unmistakable minimum-layer, at depths of 5 to 25 meters, where the salinity was lower than at the surface. At one of these (10) this layer was recorded at 10 meters (0.06‰ less saline than the surface), below which salinity increased. At another station (12) there were two such strata of low salinity, one at 5 meters (0.13‰ fresher than the surface), a second (0.18‰ fresher than the surface) at 25 meters. At the third station of this group (18) the upper 5 meters of water were homogeneous, with water 0.07‰ less saline at 25 meters; while at the fourth station (9), the upper 10 meters were homogeneous, the 25 meter level somewhat fresher, with a comparatively abrupt increase in salinity from that level down to 50 meters (Fig. 12).

When plotted horizontally, whether for the 5 meter, or for the 25 meter level, it appears that these stations showing a minimum layer fell into two separate and discontinuous regional groups. It is not clear whether Stations 10 and 12 represented a circumscribed pool, or whether they reflected the inshore edge of a more extensive area characterized by this type of vertical distribution. But it seems certain that Stations 9 and 18, closer to the land, did fall within such a pool, with a rather definite minimum layer centering at about 25 meters.

With only one month's data, it is of course an open question whether such a minimum stratum is characteristic of the locality and season, or whether it represented an unusual state. However, there is nothing novel in the discovery of layers or pools of low salinity of this sort, at small depths below the surface off the coast of California, for a minimum layer, centering at about 30 meters depth, is characteristic

of the offing of southern California in general, in summer, as described by McEwen (1916) and by Moberg (1928).

McEwen (1916) has discussed in detail the balance of forces, namely upwelling from below, evaporation from the surface, solar heat,

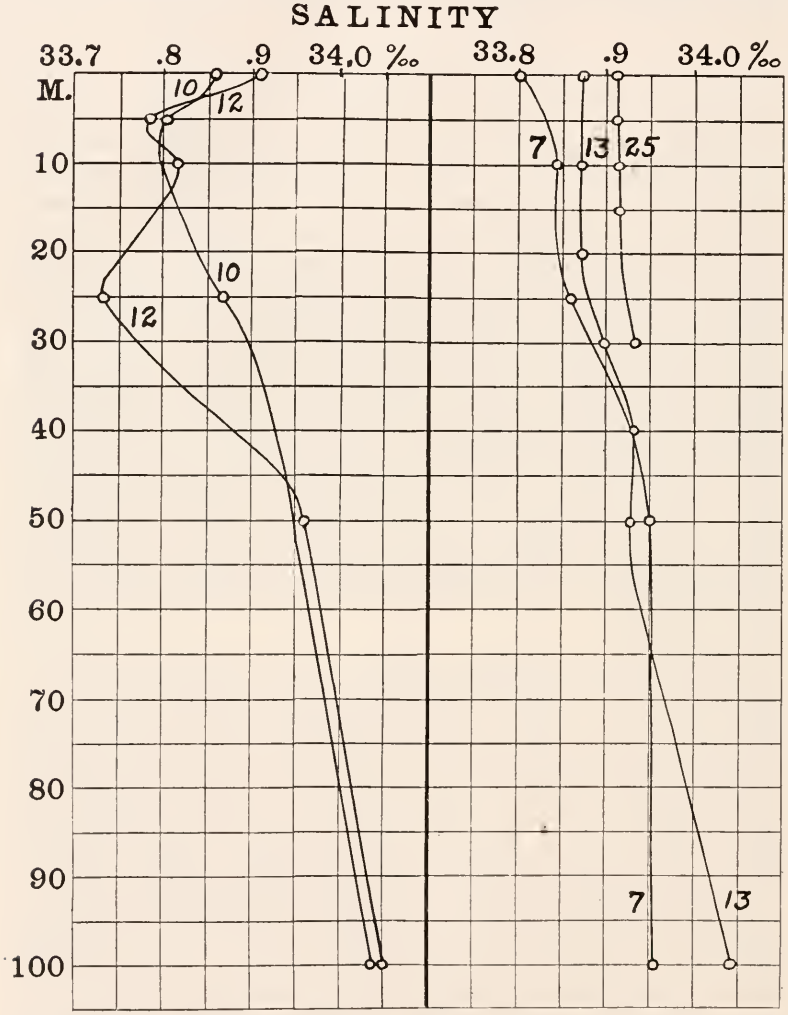

FIG. 12.— Vertical distribution of salinity in the upper 100 meters at representative stations (10, 12; and 7, 13, 25).

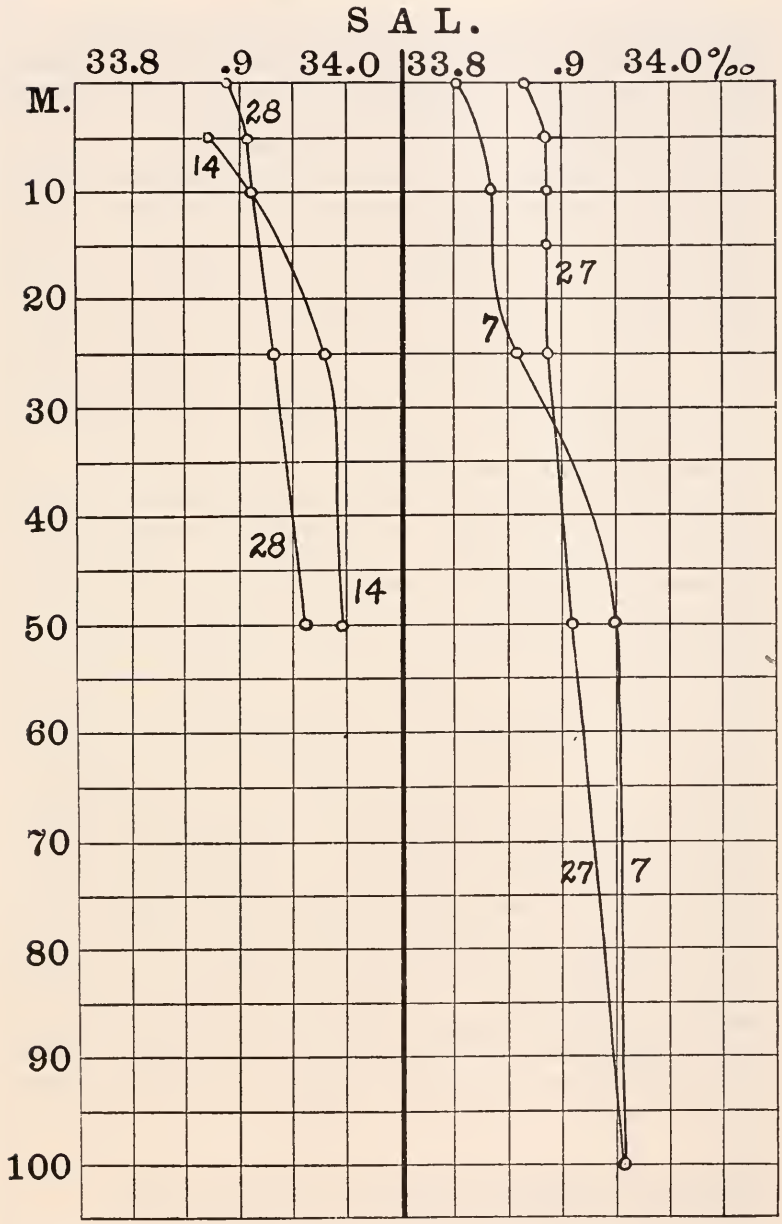

FIG. 13.—Vertical distribution of salinity in the upper 100 meters at pairs of stations off Point Pinos, July 16 and 23 (14, 28); also at the mouth of the bay, July 10 and 23 (7, 27).

convection, and salt diffusion between strata differing in osmotic pressure, by which such a layer might, theoretically, be maintained, once it had in some way been established, but so far as we have been able to learn, no explanation has been offered for its origin.

On this the profile recently run by the Carnegie expedition from San Francisco to Hawaii may be expected to throw light. One possible source is a subsurface drift of low salinity from the north. Local events may also tend to produce the phenomenon in question, in this particular situation, for the general situation with regard to the seasonal increment of fresh water is so similar all along the California coast as to make it justifiable to argue from analogy with the state prevailing at La Jolla where the winter freshening involves the whole upper stratum down to a depth of 100–150 meters and where, as McEwen (1916) shows, the upper 50 meters are nearly homogeneous as to salinity from November through February, though with some slight indication of the 30 meter minimum even at this season.

Evaporation proceeding at the surface during the spring months, after the contribution of fresh water diminishes practically to *nil*, must then increase the salinity of the surface water, and so directly tend to produce the type of vertical distribution now under discussion, stability being maintained by the thermal gradient. Thus the presence of a minimum layer, some few meters down, may be relict of the state that the whole uppermost stratum possessed a few weeks earlier, just as the persistence into the summer of a cold mid-layer in the Gulf of Maine (Bigelow, 1927), and in the Gulf of St. Lawrence (Bjerkan, 1919) reflects the previous winter's cooling there. Further progressive salting from above, by evaporation, during late summer and autumn, would then tend to obliterate this minimum layer, as the salter water so formed is carried down by turbulence; at the same time upwelling would tend to obliterate it by bringing up water of higher salinity from below. How fast such obliteration would take place would obviously depend on the activity of vertical circulation, as well as on the other factors that McEwen (1916) has discussed. The fact that traces of such a layer were found at only four stations in Monterey Bay, apparently in isolated pools, suggests that if our investigation had been postponed until a few weeks later in the season the upper 25 meters would everywhere have shown the homogeneity, or the slight salting with depth, that was characteristic of the majority of our stations in July.

Apart from the minimum pools, just mentioned, no definite regional segregation as to salinity was apparent at the 25 meter level.

At the 50 meter level (averaging about 33.95‰, and 0.08‰ more saline than the surface), the temporal alterations recorded at Point Pinos (from 33.96‰ on July 5 to 34.00‰ on July 16) and close to Monterey (from 34‰ on July 3 to 33.91‰ on July 17) were almost as wide as the total range of variation recorded for the whole bay at that level during the month. However, the station data at this level suggest a regional gradation of a sort not demonstrable at shoaler levels, from slightly higher values (>33.95‰) in the deep central part of the bay, off shore, and next the Monterey peninsula, to slightly lower (<33.95‰) over the shoal northern slope of the bay and in its southeastern bight. This distribution does not correspond to that of temperature at this level (it being accepted that high salinities and low temperatures both draw from the same deep source), for while relatively low values of temperature (about 9.3°) were recorded at some stations where salinity was relatively high (33.96–34.1‰), at one station with salinity of this value the temperature was relatively high (10.1°), while at another where the salinity was relatively low (33.91‰), temperature was also low (9.2°). But at the 100 meter level (Fig. 14) not only was a much more definite gradation in salinity evident, and a considerably wider range (33.96–34.05‰), but the distribution corresponded very closely to that of temperature (cf. Fig. 14 with Fig. 8), the least saline (corresponding to the warmest) water being localized along the trough, with the most saline (corresponding to the coldest) over its northern and southern slopes, and offshore to the southward. The implication of a distribution of this sort, in relation to upwelling, is discussed on page 467.

Although the absolute variation from station to station in salinity proved to be nearly as wide at 200 meters as at 100, the increase in depth was accompanied by decided regional equalization, the station to station range, within the narrow confines to which the rising slopes of the submarine cañon confine this depth zone within Monterey Bay, being only about 0.05‰ (34.04–34.09‰), with no definite regional gradation, i.e., only slightly greater than the observational error. And with increasing depth, station-to-station differences decreased, as illustrated by the table (p. 567) and graph (Fig. 16) until at 600 meters the water off Monterey proved as uniform in salinity (34.29‰) as it was in temperature (p. 444).

3. *Year to year variations in salinity*

The mean surface values at the Hopkins Station, for the nine years 1919 to 1927, suggest that the normal maximum for surface salinity

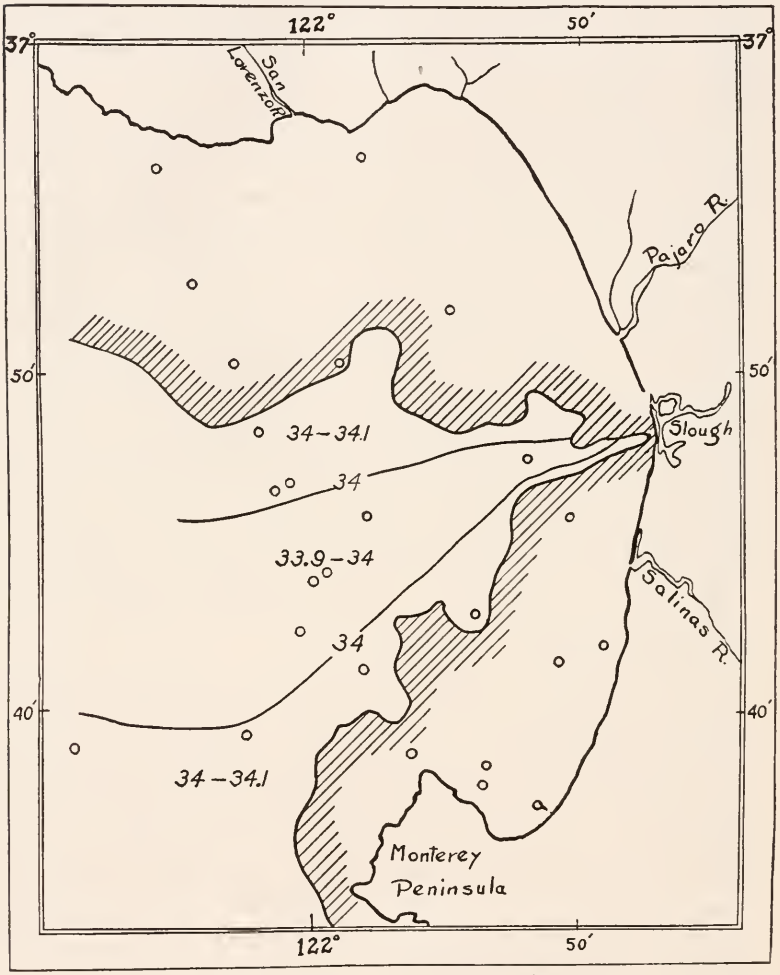

Fig. 14.— Salinity at a depth of 100 meters.

in this side of the Bay is close to 33.7‰; and that the period during which the salinity remains practically stationary usually lasts from May to August. On the whole, 1928 can be named a year of high

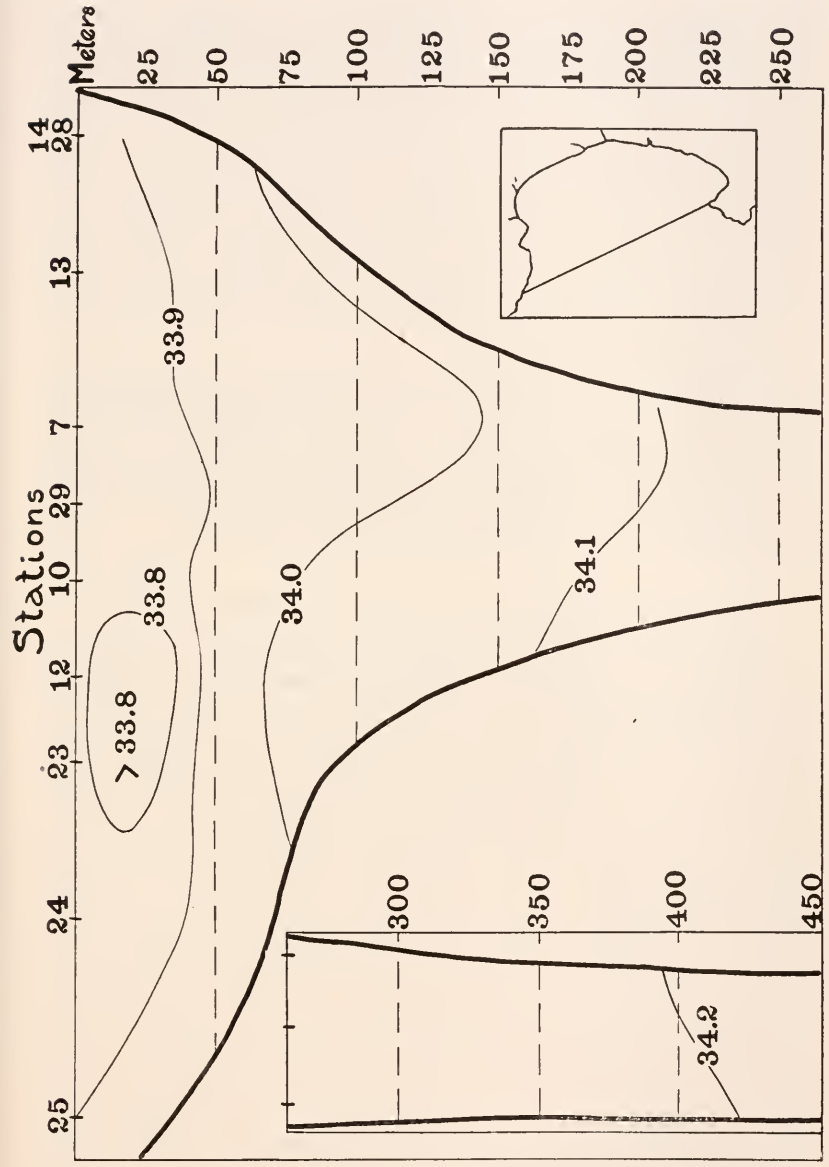

FIG. 15.— Profile of salinity, crossing the mouth of the bay, July 10–24.

salinity (Fig. 11), for the values averaged 0.1–0.2‰ higher than the nine-year mean in January–February, and again from May throughout the summer and autumn; in fact the highest values for that time of year were recorded in 1928. And with salinities averaging slightly lower than the mean in March and in May (presumably in April also), the seasonal range of salinity was also somewhat wider in that year than is usual at this station. The maximum and minimum weekly values (Fig. 11) show, however, that it is certainly an unusual event for the weekly (still more so for the monthly) means to vary from normal by more than about 0.3‰, in either direction. And the data for individual weeks show that when variations as wide as 0.3‰ do occur, they do not long persist.

Unfortunately no data are yet available as to annual variations below the surface of Monterey Bay. But the facts that the surface values have continued so constant from year to year, and that they have shown so regularly recurrent a seasonal variation in a region where the whole oceanographic complex is given its distinctive character by upwelling water, suggest that the deeper down in the water, the smaller are the variations in salinity from year to year.

4. *Salinity of Monterey Bay compared with Southern California*

If the salinity records for Monterey for July 1928, be compared with the data and graphs for the offing of La Jolla, given by Michael and McEwen (1916), by McEwen (1916), and more recently by Moberg (1928), a close agreement appears in the salinity of the surface waters of the two regions at that season. Thus surface values averaging close to 33.9‰ along shore in Monterey Bay in that July, and seldom rising above 33.95‰ there at the time, even in "salt" years, correspond closely with midsummer values of about 33.6‰ to 33.8‰ along shore at La Jolla. Except for the characteristic presence at La Jolla of a layer of minimum salinity centering at about 30 meters depth, of which only traces were found at Monterey, the vertical distribution also proved in general parallel down to 600 meters. At a depth of 100 meters, the Monterey values for 1928 average slightly higher than the mean of about 33.85‰ given by McEwen (1916, pl. 37) for the vicinity of the Coronado Islands; but, as just noted, 1928 was a year of high salinity in the upper strata of Monterey Bay. With increasing depth the relationship is reversed, the 200 meter level averaging about 34.2‰ at the Coronados in August, 34.1‰ at Monterey in July; the 400 meter level 34.3‰ at Coronado, 34.2‰ at Monterey; and the 600 meter level about 34.4‰ and 34.3‰

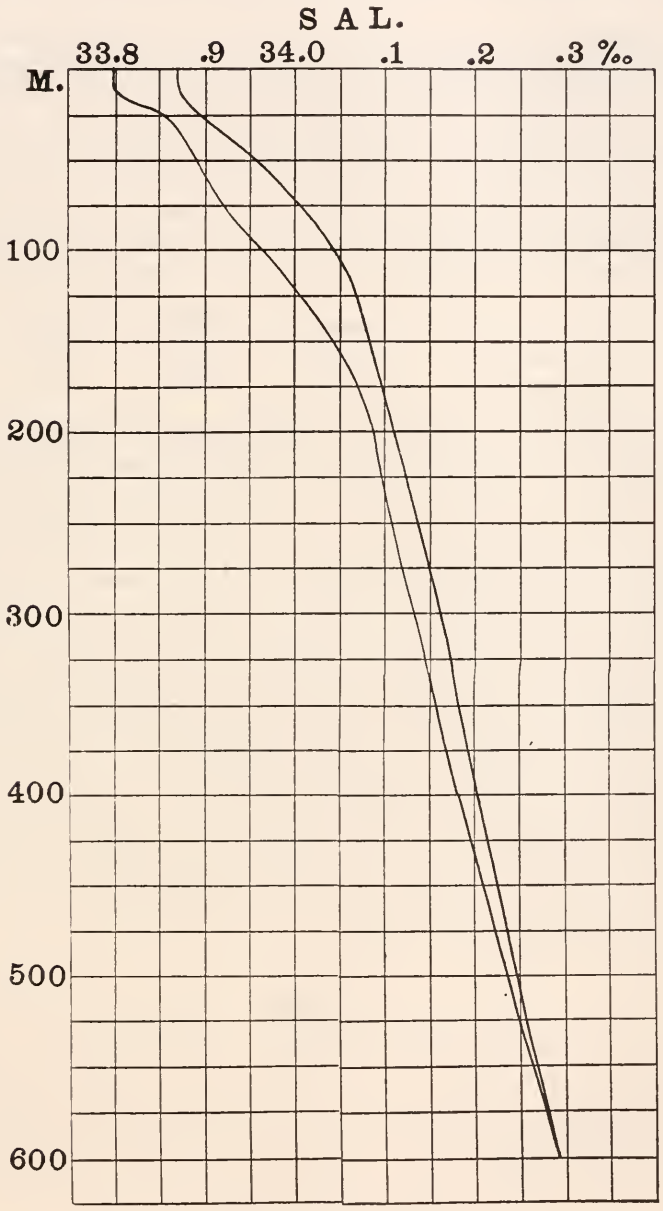

FIG. 16.— Maximum and minimum values of salinity, surface to 600 meters, Stations 8, 10, 17, 27, 29.

respectively. But the difference is so small (remembering that subsurface data are available for only one summer at Monterey) that it is the uniformity between localities so far apart, and between different years, that is striking, rather than the small divergence.

Turning, now, to the seasonal progression of salinity at the surface, we find the maximum and minimum values falling at about the same seasons off northern as off southern California, i.e., midsummer maximum, late winter minimum. The mean maximum values also agree closely. But the mean minimum values are considerably the

	Monterey	Off Coronado [1] Beach	Near Coronado [1] Island
Mean maximum	33.7‰ ±	33.8‰	33.7‰
Mean minimum	33.1‰ ±	33.55‰	33.5‰

lower at Monterey, as might be expected from the vicinity of the Salinas River, and from the greater rainfall. It is also interesting to find the type of seasonal progression that available data indicate as characteristic of Monterey (with a comparatively sudden increase in surface salinity during the late spring, and a comparatively slow decrease during autumn and early winter) more nearly reproduced offshore near the Coronado Islands, than inshore, near Coronado Beach. From the biological standpoint, however, the whole south central sector of the Californian coast line may (judging from these two localities) be regarded as a unit from the standpoint of salinity, regional differences of the magnitudes just stated being insignificant (when annual variations are weighed against them) as compared to the variations that exist along many coast lines.

Off Coronado (McEwen, 1916, pl. **26**, Fig. 46), considerable seasonal variation in salinity was detected down to at least 400 meters, with the deep water least saline during the autumn. How deep, into Monterey Bay, the autumnal and winter freshening extends, is an interesting problem for the future.

C. Upwelling

1. *Foci as indicated by temperature and by salinity*

Control of the thermal state of Monterey Bay by mass upwelling being sufficiently established, regional variations there in temperature and in salinity at any given time have especial interest as evidence of the regions where updrafts are most active at the time,

[1] From McEwen, 1916, Plate 25.

or have been most active shortly previous, and of the depth-strata within which they have recently caused the greatest thermal displacement. Similarly, the periodic variations at localities where temperatures and salinities have been determined on successive dates throw some light on the periodic pulses, even within the short time covered by the "Albacore" investigations, if the effects of local solar warming, and of wind currents within the bay be properly allowed for, this last proviso being of special importance in this particular locality.

In Monterey Bay, at the season of our survey, when the vertical range of temperature covered about seventy-five measurable units, that of salinity only about fourteen measurable units,[1] temperature is, of the two, the more useful index to upwelling. Salinity, however, has proved more instructive in this respect than the narrow range of variation might have suggested, because at the time there were no disturbing factors of local origin to confuse the picture, no rain having fallen for some time previous, while the little land drainage entering the bay in summer is negligible (p. 452).

Whereas upwelling is a process proceeding from below, it is the effects on the upper strata that are most interesting, so the rational approach to this problem is from the deeps, upward. Along the Monterey front the 600 meter level may be taken as the base plane for discussion because of the uniformity of temperature and of salinity prevailing at that depth (p. 444, 459). And as the mean values for two readings at 600 meters depth off Santa Barbara in August, 1928,[2] were likewise close to 5.5° and to 34.3‰, this would appear to be applicable all along the eastern slope of the Pacific at latitude 34° to 37° N. But as the two determinations from which this Santa Barbara mean is derived (one taken in a bowl-like depression) differed by more than a degree (4.82° and 5.98°) it is evident that the topography of the bottom, as affecting upwelling, may cause considerable local differences.

Whether profiles running farther off shore would have shown the isotherms and isohalines dipping seaward at depths greater than this, off Monterey (as might be expected if true abyssal water was then flooding up the continental slope, or had done so shortly previous) was not determined, for our outermost station lay only ten miles out from the land.

[1] Vertical range of temperature, surface to 600 meters, in July, about 7.5°; probable error of determination 0.1°; vertical range of salinity about 0.43 ‰; probable error of determination 0.03‰.

[2] Data contributed by the Scripps Institution.

Temperatures at two stations on a profile that the "Tuscarora" ran out from Pt. Carmel in 1873 suggest a thermal slope in the upper strata just opposite to what upwelling would produce, i.e., with the coldest water rising nearest to the surface at the outermost station (Belknap, 1874, p. 38, casts numbers 1 and 11). But there is some question as to the instrumental error of these early observations taken before the introduction of the reversing deep-sea thermometer. In this connection it is interesting to find the U. S. Coast and Geodetic Steamer "Guide"[1] reporting almost precisely the same temperatures at 600–650 meters (5.7° to 5.8°) off the Hawaiian Islands August, 1928, as prevailed at 600 meters off Monterey Bay the month previous.

If the spacial distribution of temperature and salinity as prevailing from July 10–24, 1928, be followed upward, from the 600 meter base level at the mouth of the bay, and inward along the trough of its submarine cañon, warping of the isotherms and of the isohalines (evidence of upwelling) first unmistakably appears at about the 250 meter level, as illustrated on the profiles crossing from headland to headland (Figs. 7, 15). But profiles do not afford a satisfactory picture of relationships from this point of view because confined to a single vertical plane, whereas it is the regional distribution that is the most instructive. The latter is made clearer by projections of temperature and of salinity at the 100 meter level (Figs. 8, 14), which, together, show that the piling up of the coldest and most saline water against the slopes of the trough was not confined to the mouth of the latter, but extended up it. At shoaler levels, however, horizontal projections of this sort do not afford satisfactory pictures of circulatory activity at the time, because the horizontal variations, whether of temperature or of salinity, were so small. It was therefore necessary to have recourse to reconstruction of the contours of successive layers of equal temperature, and of equal salinity (technically known as isothermobaths and isohalobaths), measured by the depths below the surface at which these lay. Submarine reconstruction of this sort is less familiar than the ordinary horizontal projections of temperature or of salinity; but it is not novel, having been used effectively *inter alia* by Schott (1902) in his presentation of thermal distribution in the Atlantic and Indian Oceans, based on the results of the "Valdivia" expedition.

The isothermobaths for 6° and 7°, centering respectively at about 500 and at about 380 meters depth, proved practically horizontal throughout the zone where our stations extended deep enough to reach temperatures that low, corroborating the profile (Fig. 7) to the effect that upwelling was producing no regional distortion at depths

[1] Data compiled by S. W. Chambers, 1929.

deeper than about 250 meters, at the time. But the isothermobath for 8° already suggested a definite though small warping, lying lowest along the axis of the submarine cañon, highest along the northern and inner slopes of the latter, and abreast of the Monterey Peninsula, with an extreme variation of about 40 meters between its highest and its lowest points. If this isothermobath stood alone no definite interpretation could be given it, both because only four stations were involved, because the station-to-station differences in temperature at given levels through its general depth zone were so small that the observational error of ±.1° might largely negative them, and because they covered a period of 13 days. But this distribution so clearly foreshadows that of temperature at 100 meters, just commented on (Fig. 8), and is so consistent with the isothermobaths for higher values, next to be described, that it may be accepted as an indication of the deepest thermal distortion that upwelling was then causing. Thus the indication is that the updraft tended to follow up the slopes of the trough, and towards the head of the latter, from the deepest level to which the water was involved.

This control (at least temporarily) of the underlying circulation by the contour of the bottom, resulting in its alteration into an updraft on striking the slopes, is made more evident by the isothermobath for 9° (Fig. 17) which at the time showed a slope of some 65 meters, with a much more definite valley overlying the entrance to the submarine cañon, and rising thence over the northern and southern slopes of the latter, as well as shoreward along its axis, to flatten out over the more gentle submarine slopes above. In order to avoid as far as possible the disturbing factor of temporal alteration, but at the same time to include stations generally enough dispersed, the projection (Fig. 17) covers only the period July 11–24. If station 7, occupied on July 10, were included, the relation between low and high would remain the same, but the individual contour-lines would be considerably altered, over the southern slope of the trough. Interpreted in terms of upwelling, a contour of this sort points unmistakably to an intensification of the updraft on all sides of the trough contrasted with its axis, as the surface is approached and with expansion of the area included within the picture. The isohalobath of 34‰, centering at about the same depth (Fig. 18) shows a similar contour, similarly to be interpreted, with its distortion not only corresponding regionally to that of the isothermobath for 9° but showing about the same steepness of slope. Water of this salinity also occupied approximately the same proportion of the area of the bay as did 9° temperature,

overflowed the slope to within about the same distance of the shore, and was at about the same depth below the surface at any given loca-

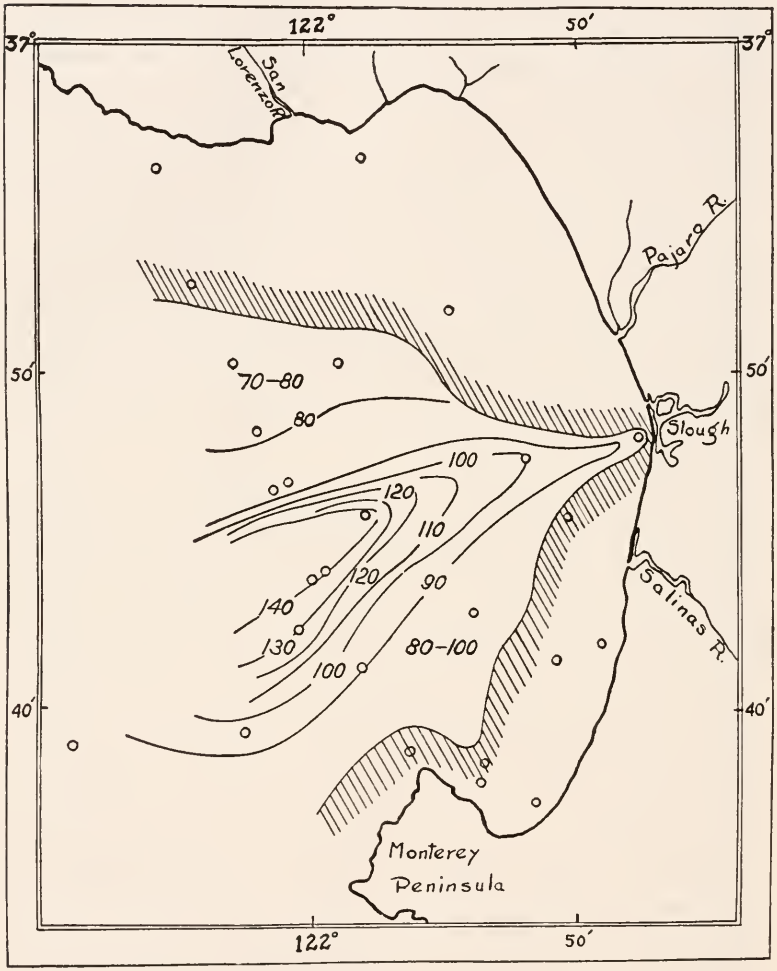

Fig. 17.— Depth in meters below the surface of the isothermobath for 9°, July 11–24.

tion in the bay. Since the precise values are stated on the charts (Figs. 17, 18) we need only add further that a closer correspondence seldom appears between any two constants of sea water.

The fact that the contour of the isothermobaths for 9.5° and 10° (Fig. 19) had the same general conformation as that for 9° shows that

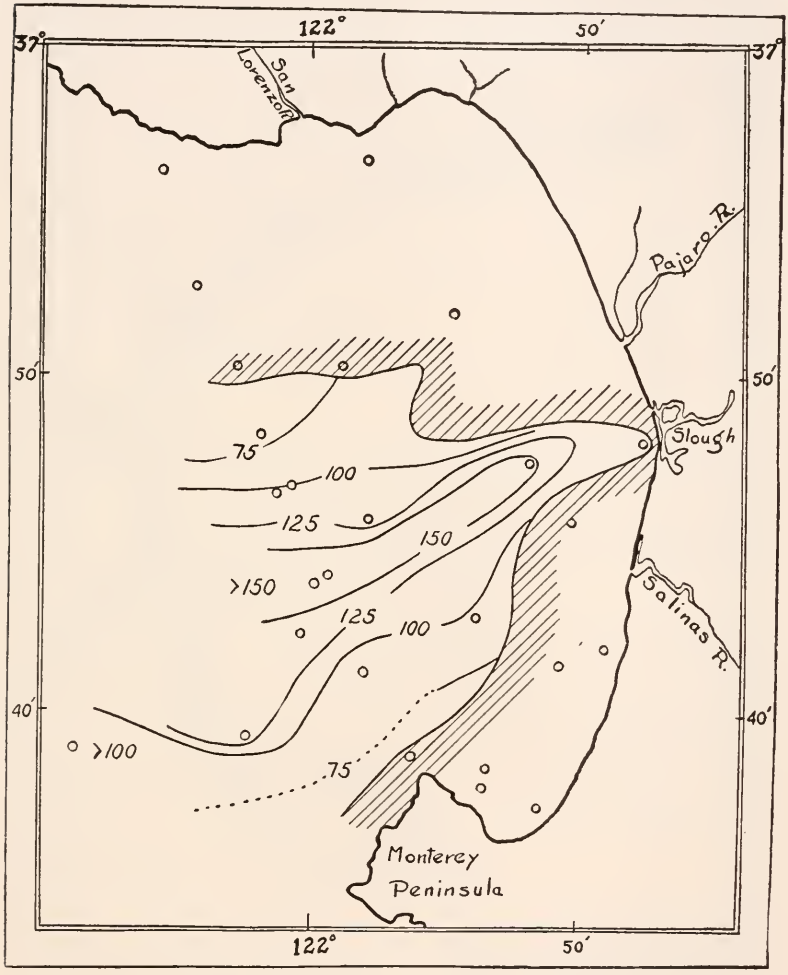

Fig. 18.— Depth in meters below the surface of the isohalobath for 34‰.

in July, 1928, this draft up the slopes, with tendency to spread in all directions shoreward over the more gradually shoaling bottom above the 100 meter depth-line, was active enough to effect considerable

thermal distortion upward to within 30–40 meters of the surface, over a large proportion of the shoaler parts of the bay. But the facts

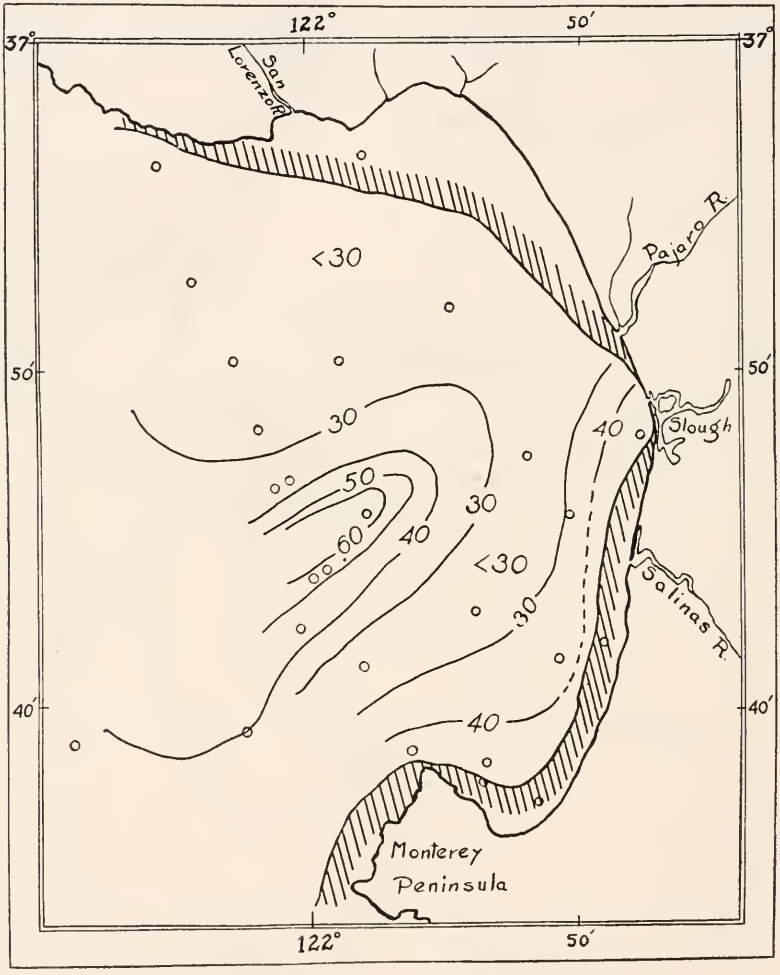

Fig. 19.— Depth in meters below the surface of the isothermobath for 10°, July 11–24.

that the slopes of successive isothermobaths decreased in steepness as the surface was neared (the difference in level between the highest and lowest points is about 65 meters for the isothermobath for 9°;

about 55 meters for 9.5°; only about 40 meters for 10°), combined with flattening of the isothermobaths over the shoaler parts of the bay, points to a slackening of the updraft in the superficial stratum, coupled with a general dispersal radial from the steepest slopes of the bottom.

When the surface was approached so closely that successive isothermobaths (e.g. for 10.5° and 11°, Fig. 20) were underlain by water columns of considerable length over most of the bay, their highest points extended as nearly level planes right across the bay from north to south, evidence that near the surface the bottom contour does not so directly control the course of the updrafts. As a result the isothermobath for 10.5° (centering at about 20–25 meters), varied by only about 23 meters in level over the entire bay during the period July 12–24, nor would introduction of the stations taken earlier in the month make any appreciable difference in this contour, while that for 11° (centering at about 15–20 meters), sloped about as much, from a depression at the mouth of the bay to an elevation around the inner parts of the latter.

The asymmetry of the bottom of the bay, with the angle of slope changing from more steep to less steep near the 100 meter depth line in the northern side, but about 100 meters deeper than this in the southern (Fig. 1), offers a reasonable explanation for the fact that the coldest and most saline water approached closest to the coastline in the southern side, as is illustrated by the isothermobath for 9° (Fig. 17) and by the isohalobath for 34‰ (Fig. 18).

Coincident with the circulatory transition from the deeper layers, where opposing submarine slopes were localizing the updraft, to shoaler levels, where freedom from such interference allowed the upwelling water to spread, depression of the successive isothermobaths corroborates the profiles in showing a reciprocal concentration of the warmest water along the southwestern shore-slope of the bay. At the time this involved chiefly the stratum enclosed between the 30 and 60 meter levels. The isothermobaths for 10° and for 11° (Figs. 19, 20) illustrate this phenomenon the most clearly.

This piling up of warm water next the land was no doubt caused by the local wind. It is now generally agreed that the cause of mass upwelling along the California coast is that the winds, a few miles out at sea, usually blow parallel to the coast and from the northerly quadrant, so that the current thereby set in motion (as deflected to the right by the earth's rotation), trends offshore, with consequent upwelling next the coast slope. The correctness of this explanation of the California upwelling, based on the Ekman theory of wind

currents, first suggested by Thorade (1909), was demonstrated mathematically by McEwen (1912, and subsequent papers). If the long

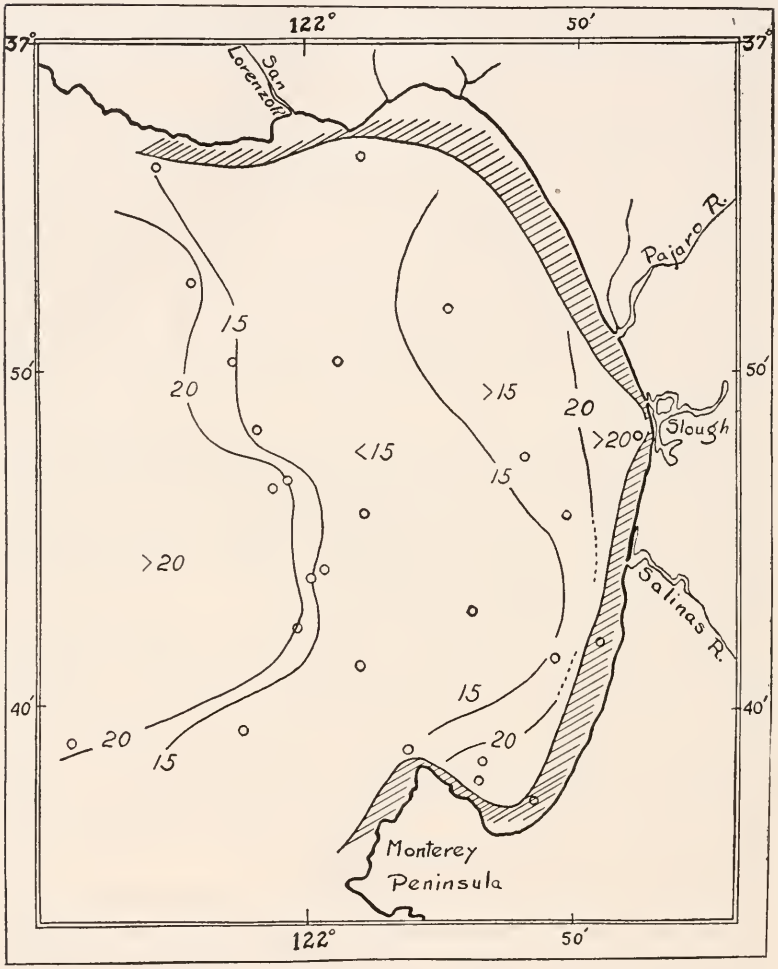

Fig. 20.— Depth in meters below the surface of the isothermobath for 11°, July 11–24.

shore wind governed right in to the coastline of Monterey Bay, the surface water of the whole bay would, on the whole, drift off shore in the same way, causing updrafts to follow the bottom slope right

in to the shore line. In that case the successive isothermobaths would slope upward, right in to the shore, with the temperature decreasing, at any given level, approaching the coast line.

Narrow coastal belts in which temperature averages low, produced by local upwellings resulting from winds driving the surface water offshore, are, in fact, familiar phenomena in many parts of the world. McEwen's (1916) analysis of temperatures and salinities along the southern Californian coast show this to be the prevailing state there. In Monterey Bay, however, the situation with regard to the wind is different. True, the wind blows almost constantly from the northwest a few miles out at sea off this sector of the coast. Thus the windrose for the appropriate 5° square on the U. S. Hydrographic Office Pilot chart of the North Pacific Ocean, for July, shows the reported winds as blowing between north and northwest 85% of the time, with none noted from other directions. This averages parallel to the general trend of the coastline, and is therefore of the type to produce upwelling in this situation. But in summer the diurnal heating of the valleys inland from Monterey Bay causes almost daily development, over the whole area of the bay, of a local sea breeze that springs up with great regularity in the morning, strengthens during the day, to die out in the evening, while the nights are as a rule windless. It is common local knowledge that this sea breeze usually blows much more strongly across the southern half of the bay (to draw up the superheated Salinas valley), than across the northern half, which is somewhat sheltered by the jutting coastline. Any drift of warm surface water set up by such a wind (as deflected by the earth's rotation) is necessarily directed toward the southeastern bight of the bay.

It is an interesting question whether resultant accumulation of a superficial stratum of warm water there, such as observed in July, 1928, ever causes the development of sinking currents, either next this part of the coastline, or at the head of the gully. The low degree of vertical stability prevailing in a water-mass as nearly homogeneous in physical characters as is that under discussion, would offer comparatively little opposition to circulation of that sort.

However that may be, it is no doubt because of this division of the winds that upwelling water was made most evident by low surface temperature well out in the bay. On the other hand the steepest thermocline [1] developed in the part of the bay (northeast bight) that is the most sheltered from the wind (Fig. 21), where solar warming of the surface can proceed most nearly at the rate normal to such a

[1] Vertical range of 5.5° in a depth of 15 meters at Station 26.

locality at the latitude in question. And this is probably the characteristic summer state.

The transition in the relative activity of vertical circulation from the state prevailing at the time in the deeper strata of the bay to that being caused in the uppermost stratum by the division in winds, combined with station to station differences in the vertical distribution of temperature caused by waves, tides, etc., makes difficult any more precise interpretation of the regional thermal differences recorded in

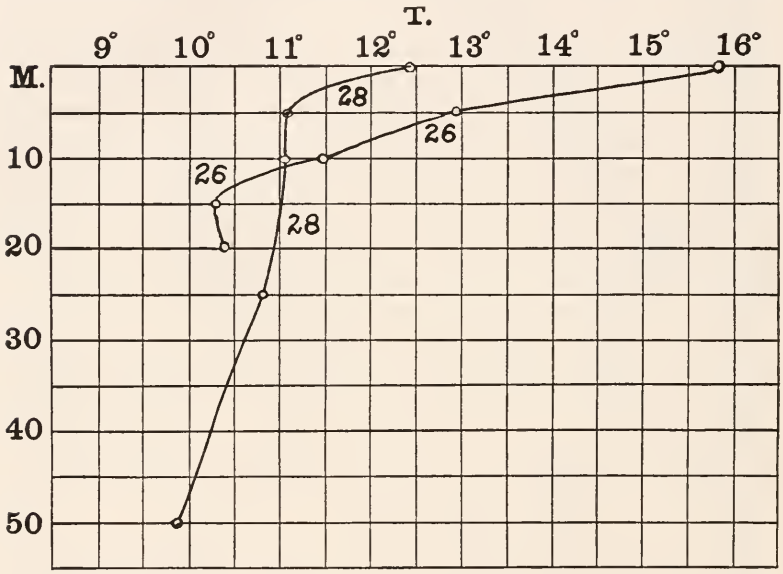

Fig. 21. Vertical distribution of temperature in the northern and southern bights of the bay (Stations 26, 28).

the upper 10 meters. In the upper 25 meters small regional variations in salinity are equally difficult to interpret in midsummer, without knowing the state that prevailed shortly previous. This is because of the strong probability that the pools of low salinity below the surface (page 455) are relicts of a minimum layer that had involved the whole bay some weeks earlier, which, in its turn, was a relict of low salinity characterizing the whole superficial stratum during the winter. If this interpretation be correct, upwelling during the early summer might either lessen or increase the salinity of the surface, depending not only on the extent to which this minimum layer still persisted,

but also on the activity of the updraft, and on the depth zone involved. Furthermore, with a minimum layer existing some 20 to 30 meters down, any sort of local stirring would freshen the surface. But in the parts of the bay where the minimum layer had already been obliterated, upwelling would increase the surface salinity.

2. *Periodicity as indicated by temperature and salinity*

It is generally recognized that upwelling, along the Californian coast is an intermittent process. To gain any reliable picture of active and inactive periods, and to determine the regularity, or reverse, of its seasonal schedule would obviously require frequent periodic record of the temperature of the central parts of the bay, as well as of its margin.

Our work in 1928 was not continued long enough to throw much light on this subject in general, except that a warming of the upper 50 meters by about 1°, at a pair of stations at the mouth of the bay, between July 10 (7) and 23 (27), suggests that the updraft over this part of the slope was more active during the first week of the month than thereafter. In line with this conclusion is the fact that near Point Pinos, surface temperature dropped by about 1° between June 30 (1) and July 5 (5); that the whole column then warmed considerably, to the 16th; with the vertical range of temperature and of salinity then decreasing (cf. Stations 14 and 28, Figs. 13 and 22) as would naturally result from stirring by tidal currents running over the broken bottom. It is interesting in this connection that the tow there, at the surface, yielded a considerable amount of algal debris at Station 28, as well as a number of species of bottom-living diatoms (p. 537) that had not been found there three weeks previously (Sta. 5).

3. *Comparison with other points on Pacific coast*

In the preceding lines we have interpreted so far as seems warranted the variations in the physical state of the water from place to place existing within Monterey Bay in July, 1928, as rough indices of vertical circulation. The data so far gathered do not justify any discussion of the actual rate of upwelling at the time.[1] But the depression of

[1] McEwen (1929) has pointed out that any such calculation must include, as elements in the equation, the periodic variation in several constants for which no data are yet available for Monterey Bay, i.e. the rate of evaporation of the surface, turbulence, solar radiation, as well as alteration in temperature, or depression of the latter below the value normal to the latitude and season.

surface temperature in Monterey Bay, at the warmest season, below the value normal for that month for the Pacific Ocean as a whole at the corresponding latitude, compared with the corresponding depression at La Jolla, gives a rough measure of the relative activity of upwelling at these two locations, and of the relative degree to which this process

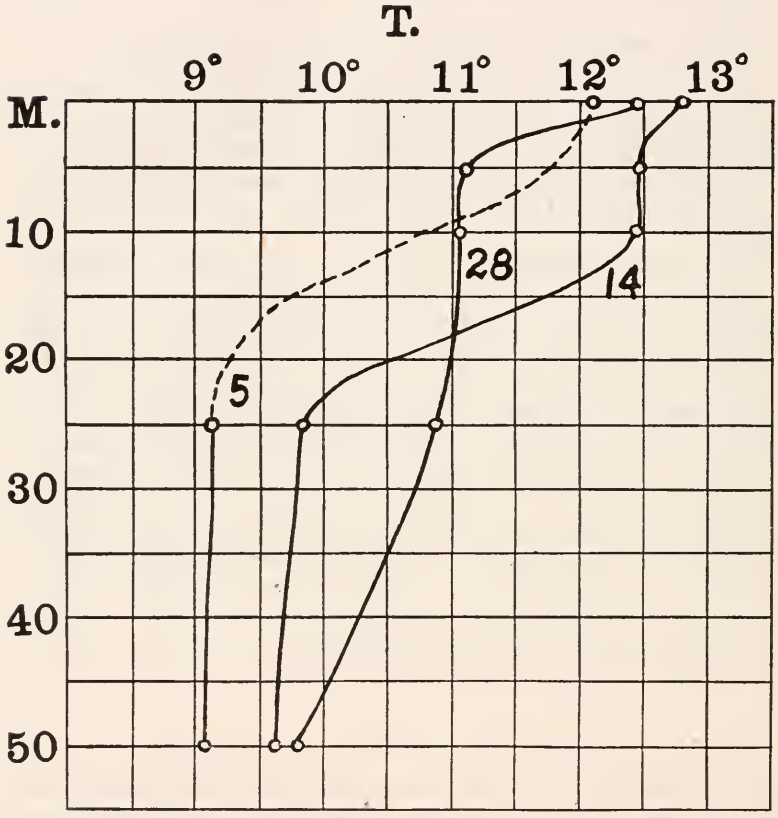

FIG. 22.— Seasonal progression of salinity near Point Pinos, July 5 (Sta. 5); July 16 (Sta. 14); and July 23 (Sta. 28).

controls the oceanographic complex off the mid Californian and the southern Californian coasts. At Pacific Grove the mean summer maximum (years 1919 to 1928) is nearly 8° lower than is normal for the latitude.[1] And while the introduction of abnormally cold or ab-

[1] Normal temperatures from calculations contributed by Dr. McEwen.

normally warm summers into the calculation would slightly alter this difference, the series has continued long enough to show the orders of magnitude involved. There is no season when the coastal belt off Monterey Bay is not colder than the normal for the latitude; at the coldest season it averages about 1.7° colder than normal, proof that

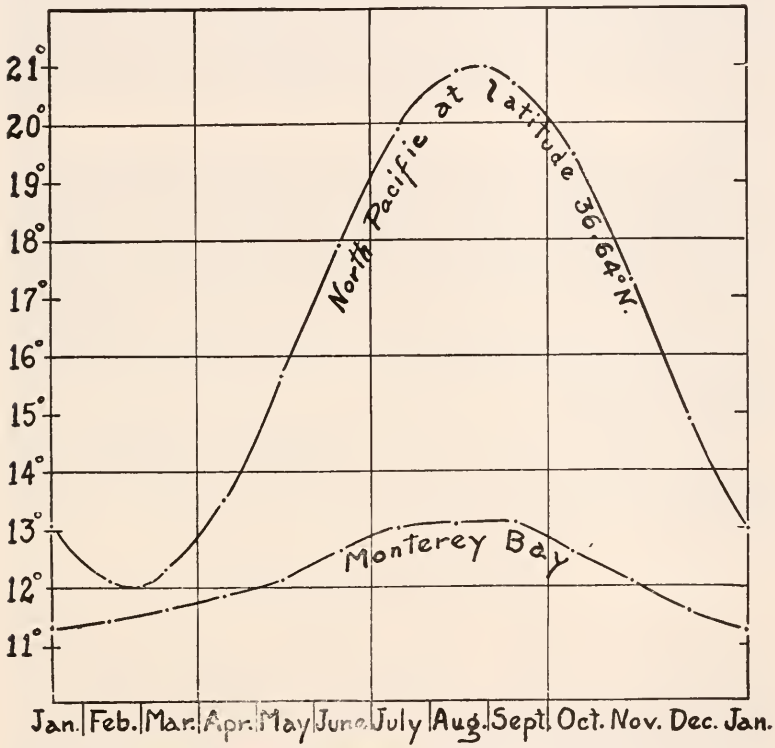

FIG. 23.— Average surface temperature of Monterey Bay, for the year, based on records for 1919–1928 (lower curve), and normal surface temperature for the North Pacific as a whole at the corresponding latitude from calculations by G. F. McEwen (upper curve).

upwelling takes place throughout the year. The fact that Monterey surface waters chill to their minimum temperature about six weeks earlier than the expectation, i.e. in January instead of early in March (Fig. 23), with no apparent explanation from local conditions, suggests that on the whole upwelling reaches its greatest volume there during the autumn.

In the region of La Jolla the maximum (about 20°) is depressed only about 3° [1] below the value normal for the latitude. In the vicinity of Cape Mendocino, lat. 40° N, where the lowest surface temperatures for the whole Californian-Oregon coastline are usually encountered in summer, McEwen's (1912, p. 268) calculations show the maximum midsummer temperature depressed about 7°–8° below normal. And observations at Blunt's reef, near the Cape, showed about this same depression in summer, for the years 1922–1928.[2] In midwinter the water off the Cape is about normal in temperature by the earlier data, but about 1° warmer than normal according to these more recent records.

Without entering further into the theoretic aspects of the question, it is evident that upwelling much more effectively controls the physical character of the water in Monterey Bay than in the vicinity of La Jolla. The small regional range of surface temperature at Monterey, the fact that the difference of about 7° between the seasonal maxima for these two localities is much greater than could be explained on the basis of a difference of latitude alone, and the greater prevalence of fog at Monterey in summer than at La Jolla, would indeed have suggested as much.

Such evidence as is now available suggests that upwelling is about as active off Monterey as it is in the coast sector just north of San Francisco, or at least that it is about as effective in chilling the surface water.

D. Horizontal Circulation

In the preceding pages we have emphasized the vertical circulation of the bay, both because this gives the bay — and the California coast sector as a whole — its peculiar oceanographic character, and because our observations were of a sort to throw some light on the loci of upwelling at the time.

It is obvious, however, that wherever this type of circulation brings cold, highly saline — and consequently heavy water up to the surface, in juxtaposition to lighter water, it must at the same time cause a dynamic tendency toward horizontal motion, following the gravitational force that tends to bring the water back into a state of horizontal equilibrium. Certainly this dynamic tendency toward current

[1] Normal temperatures from calculations contributed by Dr. McEwen. McEwen's (1912, page 265; 1916, Plate 25, fig. 42) earlier calculations, based on less extensive data, showed slightly lower maxima and higher minima.

[2] Information contributed by Dr. G. F. McEwen.

development varies regionally, and periodically, with the activity of upwelling, as well as with the time of year, thus complicating the problem of tracing the horizontal drift that is set in motion locally by the prevailing wind.

In general, according to ship reports, the dominant movement of the surface waters abreast this part of the coast is toward the south, as represented on the pilot charts — the "California current." But so far as we have been able to learn, no analysis of horizontal movements has been attempted for Monterey Bay.[1]

1. *Tides*

The tidal currents setting in and out of the bay are strong. According to the U. S. Coast and Geodetic Survey (1929) the velocity of the flood, at its strength, is about 1.1 knot past Point Pinos on the one side of the bay, about one knot past the Santa Cruz shore on the other, the inward and outward currents running, in each case, parallel with the coast line.[2]

Small tide rips and choppy seas also give evidence of strong tidal currents over the slopes of the submarine trough of the bay, near its mouth. But local reports as to the direction of the dominant set (if any) within the bay are conflicting.

Our own observations do not afford any direct evidence on this question. But knowledge of the direction of the dominant drift is so important for understanding the distribution and especially the migrations of the local fauna, that it seems worth while to outline the dynamic state prevailing at the time of our survey.

2. *Dynamic state*

Off a straight coast line and slope, a band of continuous upwelling, along shore, would tend to maintain a continuous band of high specific gravity next the coast. But where, as in Monterey Bay in July, 1928, upwelling is localized and directed by the slopes of a submarine trough running roughly at right angles to the general trend of the coast line, a much more complex situation is to be expected. Furthermore, the dynamic gradients may be expected to alter rapidly, according as upwelling becomes more or less active.

[1] Drift bottles, and other floats, have been put out in the bay, in connection with surveys for a proposed breakwater, but the results have not been made available as yet.

[2] The flood is described as averaging about N 35° E past Point Pinos, S 80°E past Santa Cruz light.

During the last half of July, 1928, both the temperatures and the salinities of the upper 50 meters of Monterey were so uniform from station to station, and consequently the superficial layer was so stable, horizontally, that the maximum dynamic gradient for the stratum included between the surface and the 50 decibar level was only about 1.3 dynamic centimeters between the offing of the bay (Sta. 17) and the head of the gully (Sta. 19), 0.5 dyn. cm. across the mouth of the bay. It is necessary, however, to take the whole column of water into account, not the superficial stratum alone, because temperatures and salinities showed more dislocation in the mid-depths than at the surface.

In one respect Monterey Bay, in summer, offers a decidedly favorable field for studies of this sort, because the water proved so nearly uniform as to specific gravity at 500 meters and deeper, both within the trough and in the offing, as to suggest that this level can usually be taken as a stationary base for the dynamic calculations.

The differences in depth from station to station, resulting from the steepness of the bottom slope, are, however, greater than can properly be allowed for by any empiric method of calculation yet proposed. Consequently, while the direction of the dynamic slope represented on the accompanying chart (Fig. 24) seems sufficiently established for the time of observation, its precise steepness, and the velocities calculable therefrom, can only be taken as rough indices to the orders of magnitude that actually were indicated during our survey.[1]

Even without the construction of such a chart, the evidence of temperature, showing relatively cold water banked up against the slopes of the trough, and spreading shoreward over the shoaler bottoms to north and south, as described above (p. 467) suggests that when upwelling is active, the updrafts of heavy water over the slopes, contrasted with the comparatively quiescent state along the axis of the trough, tend to establish an anticyclonic system of circulation at the mouth of the bay. And this is corroborated by the dynamic projection, which shows that the surface then stood dynamically highest over the mouth of the trough and up the axis of the latter, dynamically lower over the shallows within the bay, to the north and south. Corresponding to the distribution of bottom temperature (p. 467), the

[1] The dynamic contour chart (Fig 24), calculated by the Bjerkenes theorem, is of the sort now widely employed. For a recent description of the method of calculation, see Smith, (1925). Differences in depth, between adjacent stations, have been allowed for by the empiric correction introduced by Jacobsen and Jensen (1926). This method was chosen, rather than the simpler alternative recently developed by Harvey (1929), because of the necessity for taking the contour of the bottom into account.

surface was then dynamically lowest in the whole northern half of the bay, and practically uniform there regionally. Our survey did not

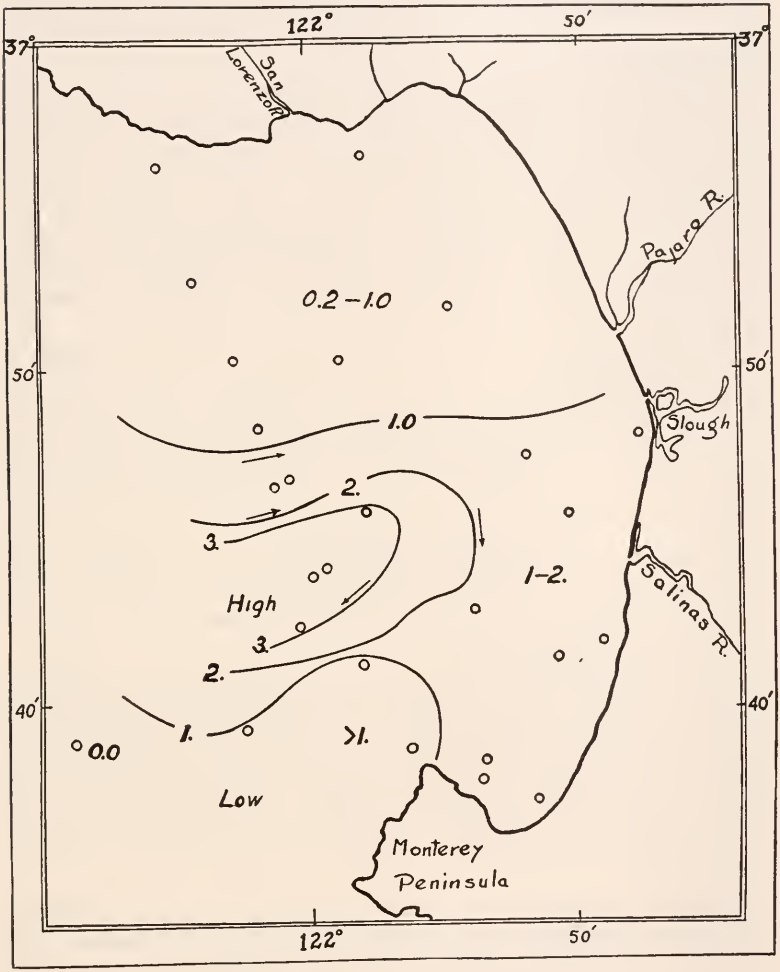

FIG. 24.— Dynamic gradient and indicated drift, at the surface, July 10–24, referred to the offing of Point Pinos (Sta. 17) as base station. The dynamic heights are given for every one dynamic centimeter.

extend far enough offshore to show whether the dynamically high centre (representing low specific gravities), was a circumscribed pool,

as is suggested by the fact that the surface was dynamically lowest (i.e., the mean specific gravity of the whole column of water greatest) at our outermost station (17), or whether it represented an extension inward along the trough of a state generally prevailing farther offshore at the time.

The circulatory implication of a dynamic distribution of this sort, at the situation in question, is clearly the development of a clockwise eddy (relative to the chosen base level), around the centre of low specific gravity, either closed, or forming a sector of the general north-south drift, according to whether the high centre did or did not represent an isolated pool. And since evidence is strong that the base plane (500 meter level) was practically stationary at the time, the actual surface drift probably was of the sort that the dynamic calculation calls for.

By contrast, the whole northern part of the bay was dynamically "dead" at the time.

In general this distribution suggests dynamic tendency for an indraft to enter the bay along the northern side of the trough, an outdraft to leave it around its southern side, as indicated on the chart (Fig. 24) by the arrows. But in the inner parts of the bay the dynamic gradients were so small, the tidal and wind currents so strong, and the directing effect of an almost straight coast line so immediate, that some more direct line of evidence is needed to show how closely the prevailing drift around the coast line of the bay did actually correspond to the dynamic calculation.

For the reason just stated, calculated velocities are not of much value in this case: may, in fact, be more misleading than instructive. Therefore, we need only remark that in the central part of the bay, where the dynamic gradient was then steepest, the calculated velocity around the southern side of the clockwise eddy (Sta. 13–27) was about 0.9 cemtimeter per second (0.18 knot), or at the rate of about 4.3 miles per day; only about one third as great at the northern edge of the eddy.

There is no warrant for assuming that the dynamic contour existing during the last half of July, 1928 represented a long continuing state, or that it is regularly representative of the summer season. On the contrary, every fresh updraft from below necessarily alters the tendency toward horizontal circulation by distorting the existing distribution of dynamic contours by introducing heavy water into or one another part of the picture in the upper levels. And whenever upwell-

ing slackens, the gravitational tendency toward regional equalization reduces the existing gradients.

The decrease that took place in the specific gravity of the water at the situation of Stations 7 and 27, between July 10 and 23, in the upper 50 meters of water (table, p. 567), illustrates the rapidity with which such alterations may occur in the dynamic state of Monterey Bay. Nevertheless, theoretic probability so closely agrees with actual observation, that upwelling in Monterey Bay brings heavy water near the surface chiefly over the slopes of the submarine trough, as to make it likely that the existence of some such clockwise dynamic centre, over the axis of the latter, is characteristic of midsummer. One other disturbing factor besides wind currents (p. 473) must, however, be taken into account, namely, the progressive motion, around the bay that the deflective effect of the earth's rotation should, theoretically, give to the horizontal tidal oscillations (Huntsman, 1924; Bigelow, 1927). Theoretically this calls for a circulation of the reverse order, i.e. anti-clockwise, or from south to north around the shores of the bay, a discrepancy pointing the complexity of the circulatory problem that still remains to be solved there.

V. Chemical Oceanography

A. Dissolved Nutrients

1. *State prevailing in July, 1928*

Between July 10 and 24 the concentrations of dissolved phosphates and silicates were determined for vertical series at eighteen stations, three of them extending down to depths of 600 meters, one to 500 meters and one to 400, while surface measurements were made at three more stations. Nitrates were also determined at eight serial stations and at four others at the surface. For discussion of the methods, see p. 431. These data are valuable for comparison with the amounts of phytoplankton present at the time (p. 512), and for the light that the regional and vertical distribution of these chemical substances may throw, both on the efficiency of upwelling as an agency for the renewal of fertility in the upper strata of water, and as indications of the places where organic substances are most rapidly going into solution on the bottom.

Phosphate and Silicate

The distribution, regional and vertical, of phosphates and silicates was so nearly alike that these two solutes can be treated as a unit.

At the surface both of them showed considerable variation, phosphates ranging from about 0.009 to about 0.069 milligrams per liter,

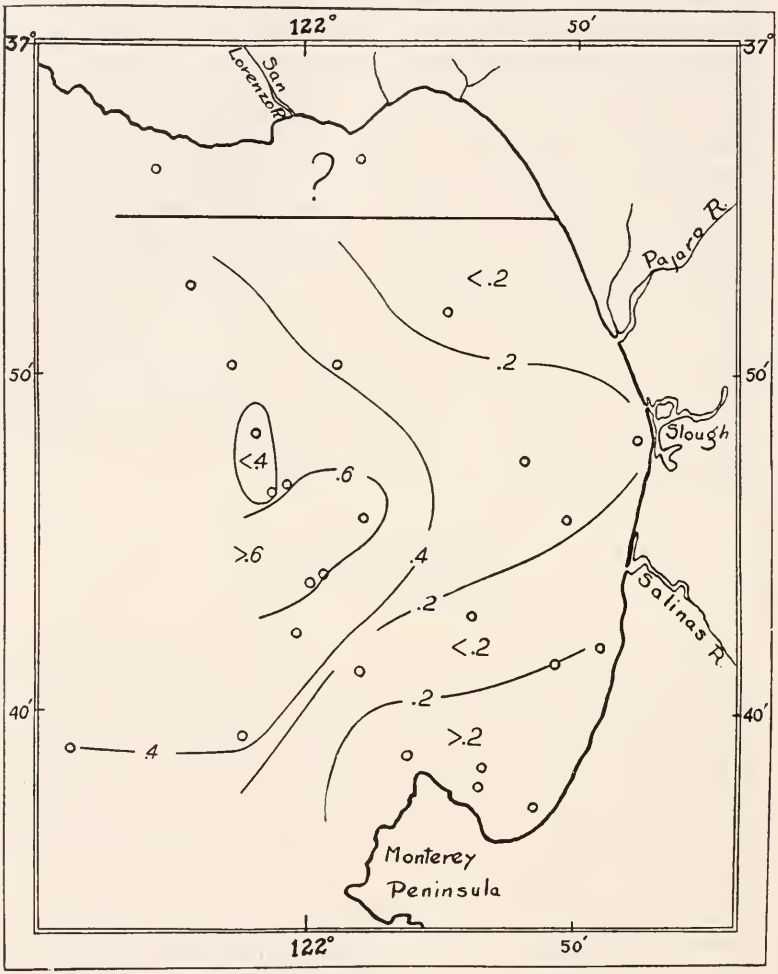

Fig. 25.— Distribution of silicates (as milligrams per liter of SiO_2), at the surface.

silicates from 0.143 to 0.78. To find so wide a range at the surface within so small an area is unusual. It is difficult to measure less than 0.05 milligrams per liter of silicate or 0.005 milligrams per liter of phos-

phate with any speed and accuracy. The minima in both cases were only slightly greater than these amounts, while the maxima were close

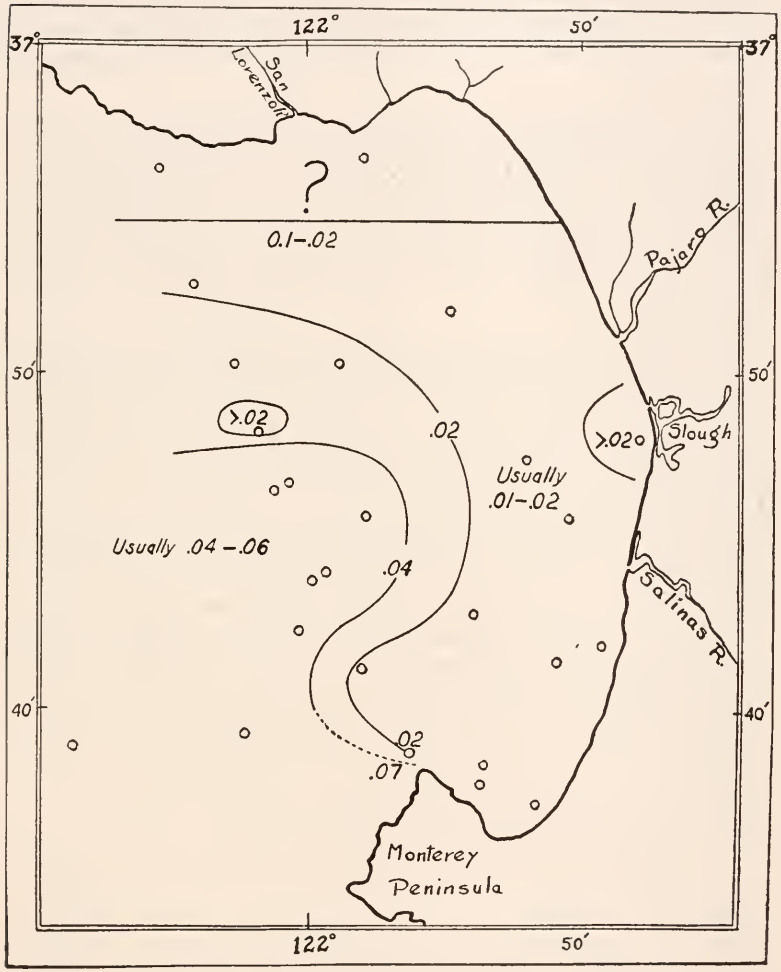

Fig. 26.— Distribution of phosphates (as milligrams per liter of P_2O_5), at the surface.

to the average values that characterized the 25–30 meter level at the time. The regional distribution for both (Figs. 25, 26) was characterized by relatively high values over the mouth of the submarine cañon,

lower over the inner parts of the bay generally, and the regional gradation was about equally abrupt for the one substance as for the other, except in the vicinity of Point Pinos, where relatively high values as well as low were recorded. Both charts (Figs. 25, 26) furthermore, show the rich offshore water interrupted, midway across the bay, by barren pools.

The mean surface value for phosphate at the time was about 0.036 mg. per liter; for silicate about 0.4, the orders of magnitude involved being about ten times as great for silicates as for phosphates. This is the ratio that usually obtains at La Jolla also. We may point out in passing that arithmetical averages of the station records can only give a rough indication of the mean values for the bay as a whole, because the localities of record were not distributed regularly enough over the area.

In the upper 10–15 meters various irregularities and small reversals were recorded from the surface downward, as illustrated by the graphs for individual stations (Fig. 27). But the vertical distribution of silicates and of phosphates was similar from 15 to 250 meters at most of the stations (Fig. 28), both of these substances showing an uninterrupted increase in richness downward, either to the bottom or to the greatest depth reached, at every station but one (as has usually proved true elsewhere). In spite of the irregularities just noted for the superficial stratum, and in spite of the fact that the mean value at 10 meters was, in neither case, appreciably higher than at the surface, most of the stations showed considerably greater increase in both silicates and phosphates between the surface and a depth of 50 meters than in any stratum of corresponding thickness at greater depths, a fact reflected by a dislocation in the curves at the 50 meter level for most of the stations. From that depth downward the rate of increase was not only slower in most cases, but continued nearly uniform down to the deepest level reached; usually close to the bottom.

In fact the curves for silicates and phosphates were in most cases so nearly parallel from the surface down to the 200 meter level (if drawn to appropriate scale) that if superimposed they would be close to coincident. But at depths greater than 200 meters the two classes of curves diverge, enrichment being slightly more rapid, with depth, for silicates than for phosphates. This difference is illustrated by the graphs for the mean values for silicates and phosphates (Fig. 28): also by the mean increase for intervals of 50 meters tabulated below (p. 488). Its significance is discussed on p. 504. At the one station (9) which by showing a considerably lower value at 200 meters than

at 100, formed an exception to the rule that phosphates increased regularly with depth, the vertical distribution of silicates was of the more usual type. And at one other station (17) where the water was homogeneous as to phosphates from a depth of 50 meters down to 200 meters, silicates showed the usual increase.

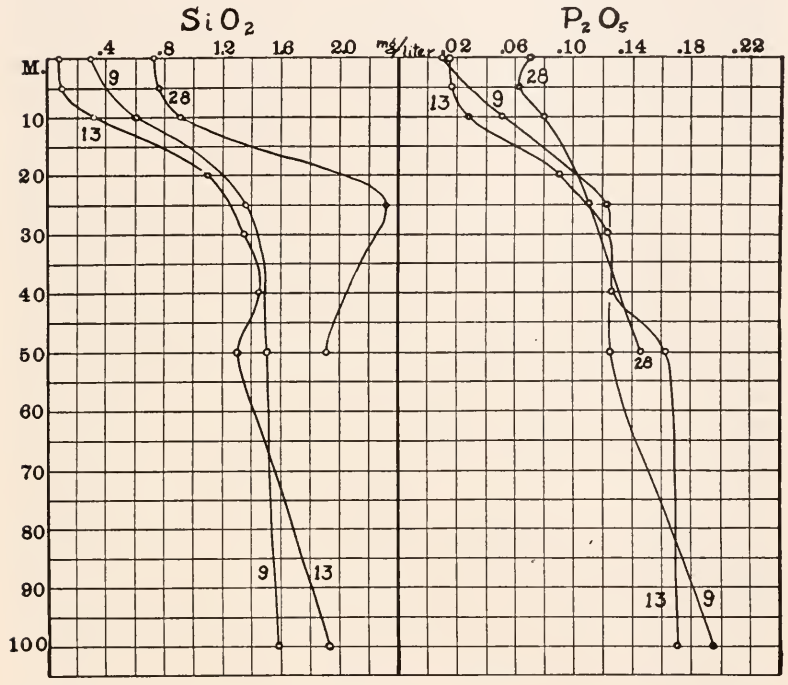

FIG. 27.— Vertical distribution in the upper 100 meters, of silicates (as SiO_2) and of phosphate (as P_2O_5) in milligrams per liter, at representative stations (9, 13, 28).

We refer the reader to the following table (p. 488) for the maximal, minimal, and mean values for silicates and phosphates at different depths, pointing out that the water was about six times as rich in silicates and five times as rich in phosphates at 600 meters as it averaged at the surface, although only about 1.001 times as rich in total salts.

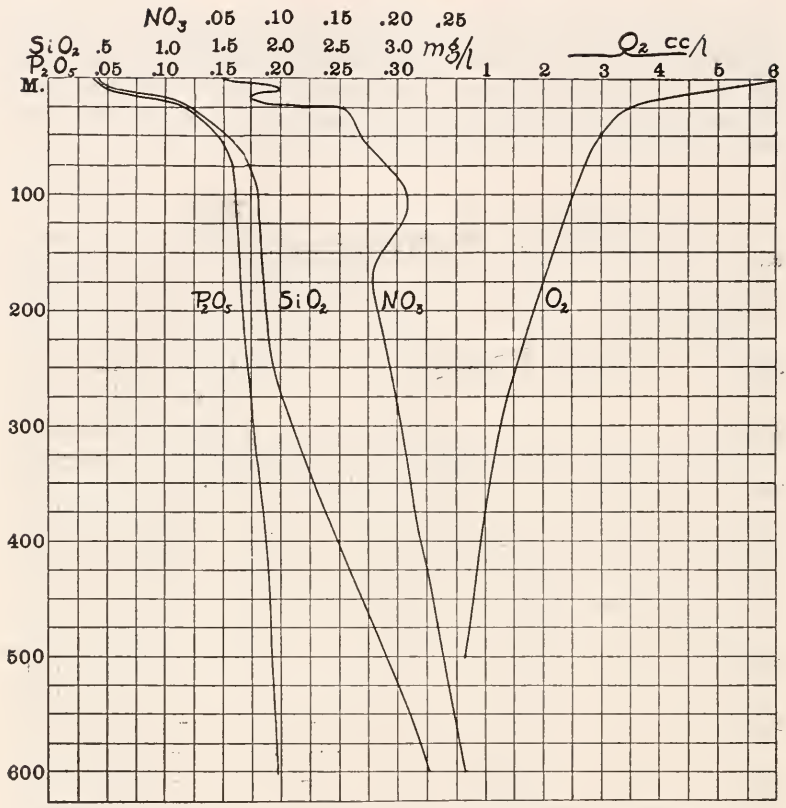

FIG. 28.— Mean value, for all stations of record, of phosphates (as P_2O_5), of silicates (as SiO_2), and of nitrogen in the form of nitrate, in milligrams per liter, and of dissolved oxygen in cubic centimeters per liter reduced to pressure of 760 mm. of mercury and temperature of 0° C.

Maximum, minimum and mean values for silicates (as SiO_2) *and phosphates* (as P_2O_5) *in milligrams per liter*

Depth meters	Silicates			Phosphates			Mean Increase per 50 meters	
	Max.	Min.	Mean	Max.	Min.	Mean	Silicates	Phosphates
0	.78	1.43	.40	.069	.009	.036		
							1.11	.106
50	1.90	1.13	1.51	.163	.118	.142		
							.26	.016
100	2.41	1.38	1.77	.196	.134	.158		
							.05	.004
200	2.41	1.61	1.87	.196	.142	.166		
							.15	.005
400	2.91	2.39	2.49	.200	.175	.186		
							.19	.005
600	3.57	3.06	3.27	.217	.196	.207		

Irregularity of the station to station differences from the surface down to 50 meters added to the comparatively wide limits of variation at the surface, but uniformity at the deeper level, points to an unstable state, and to the probability that if observations had been taken shortly earlier, or shortly later in the season, or if they had been compressed into a shorter period, a different regional picture would have resulted in the superficial stratum of water. Close to Point Pinos, for instance, silicates increased from 1.456 mg/li on July 16 to 2.308 on July 23, but the value for phosphates was almost precisely the same on the later date as on the earlier (0.115 and 0.114 mg/li, respectively).

These complexities, however, smoothed out at depths greater than those to which the depleting influences of the plankton, and the disturbing effects of waves, etc., extend. Thus horizontal projections for the 50 meter level show that no definite separation into rich or poor areas was possible for phosphates at the time, slightly higher values appearing as more or less isolated pools at some stations, slightly lower values at others. A corresponding chart for silicates would be similarly uniform, as compared with the surface; the contrast between high surface values off the mouth of the cañon and lower at the western side of the bay, is but slightly indicated at 50 meters, the existence of the rich surface pool, next the Monterey Peninsula, but faintly reflected by values slightly higher there (1.56 and 1.88 mg/li) than in the adjacent band of water offshore.

This regional equalization of the chemical state of the water from the surface downward to 50 meters parallels that of temperature (p. 438). With increasing depth, below the 50 meter level, silicates, like temperature (p. 443) and salinity (p. 459) again showed progressive localization of relatively high and low values and of the same sort, namely, concentration of the highest values along the margins of the submarine valley, to a maximum right up at the head of the latter, with values lowest along the axis of the trough, and out at sea. This regional correspondence between silicates and temperatures in the mid-depths is best illustrated by the charts for the 100 meter level (Figs. 8, 29). But the agreement is not complete because the values for silicates were considerably lower at our outermost station in the deeper strata than they were closer in to this part of the slope.

Lack of data for one of the critical stations (29), makes it unsafe to reconstruct the distribution of phosphates at the 100 meter level. If the phosphate value was relatively low at that station, as the silicate value certainly was, essentially the same picture would result for phosphates as for silicates in the inner part of the bay, as might be

expected from the generally close agreement between the two. The regional gradation for phosphates off the Monterey Peninsula at the

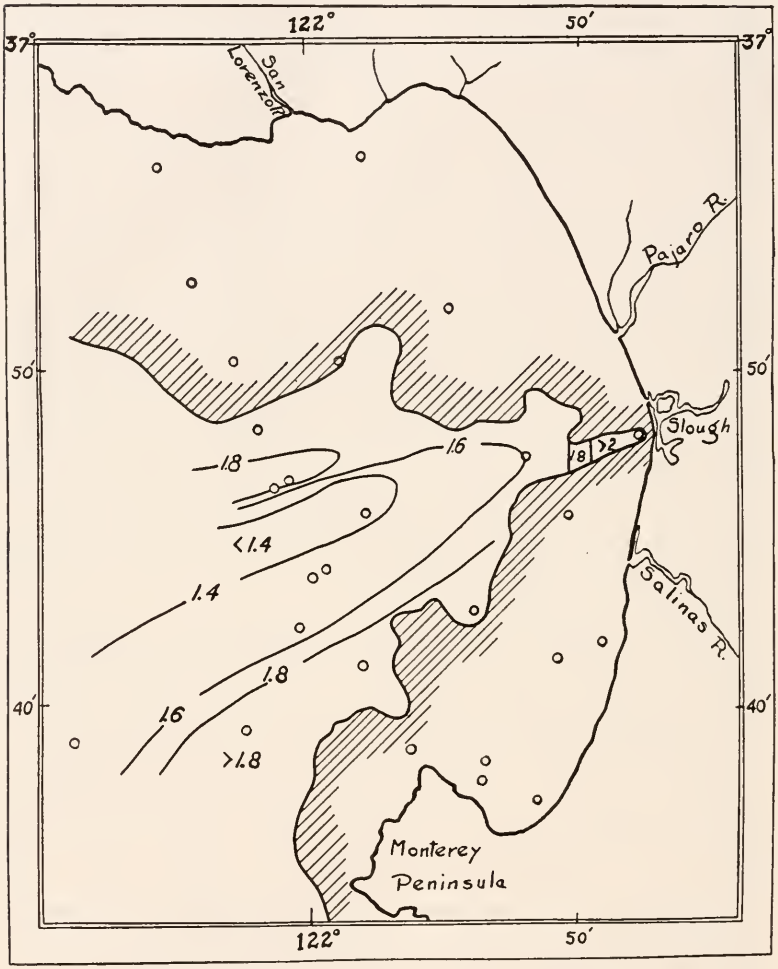

Fig. 29.— Distribution of silicates (in milligrams per liter of SiO_2) at a depth of 100 meters.

100 meter level, was essentially like that for silicates, with a decrease in richness from coast slope seaward. Furthermore, the 100 meter water was richest in phosphates at the head of the trough (0.168 mg/li

at Station 19) just as it was for silicates; least so at the outermost station (Sta. 17, 0.143 mg/li), while the profile for phosphates (Fig. 31) like that for silicates (Fig. 30) shows an unmistakable piling up of the richest water on the north and south slopes of the trough in the stratum between 50 and 150 meters, though not to as great a degree.

At depths greater than 100 meters the regional range of variation decreased both for phosphates and for silicates with increasing depth, corresponding to the contraction of the area involved. But even as deep as 600 meters the station to station variation for phosphates was seven times the experimental error, the variation for silicates 25 times the experimental error.[1]

In the case of silicates, horizontal projections, like the profile (Fig. 30) show that the concentration of the richest water around the slopes of the trough involved the whole mass of water down to a depth of 400 meters. Thus the distribution of silicates was essentially the same at the 200 meter level as at 100 meters (Fig. 29), except that the absolute maximum was recorded off the Monterey peninsula at the deeper level instead of at the head of the trough. And even at 400 meters the values of silicates were appreciably higher at our two stations over the northern and southern slopes than at the three other stations in the deep trough. But with increasing depth this distributional type gave place to a regular gradation from low values offshore, and over the southern slope of the trough (3.06–3.19 mg/li), to high (3.57 mg/li) over the northern slope of the latter. The significance of so great a difference in silicates, at the deepest level of observation, between locations only 10 miles apart, contrasted with the uniformity of temperature and of salinity, is discussed on page 504.

At depths greater than 100 meters an equally striking difference appears between the regional distribution of silicates and that of phosphates, for at 200 meters the latter (Fig. 32) were lowest at the head of the trough (Sta. 9), where silicates were high, and highest at the station at the mouth of the trough (Sta. 17) where silicates were lowest (Fig. 33). At the 600 meter level maximum values for phosphates (0.127 mg/li) at the outermost station, minimum (0.196 mg/li) over the northern slope of the trough, again reverse the silicate distribution.

[1] With the values prevailing at this depth, the experimental error is about 0.004 mg/li for phosphates, 0.04 mg/li for silicates.

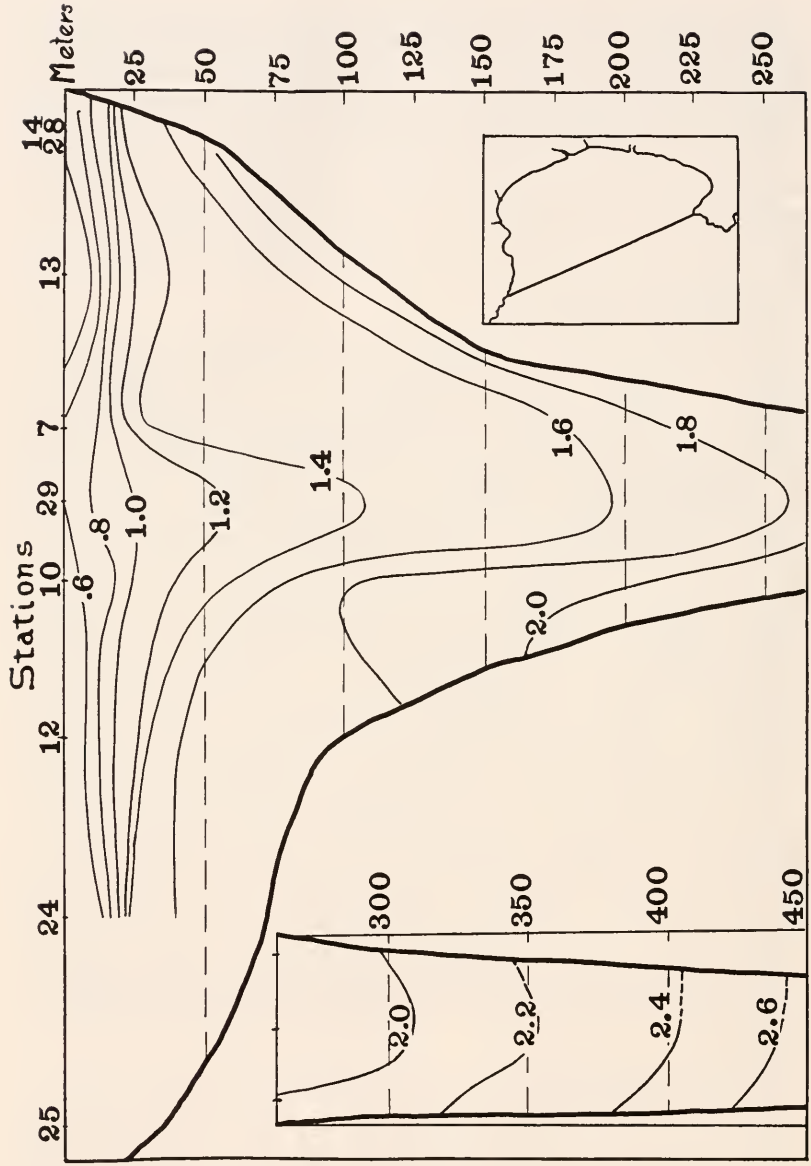

Fig. 30.— Profile across the mouth of the bay for silicates (in milligrams per liter of SiO_2).

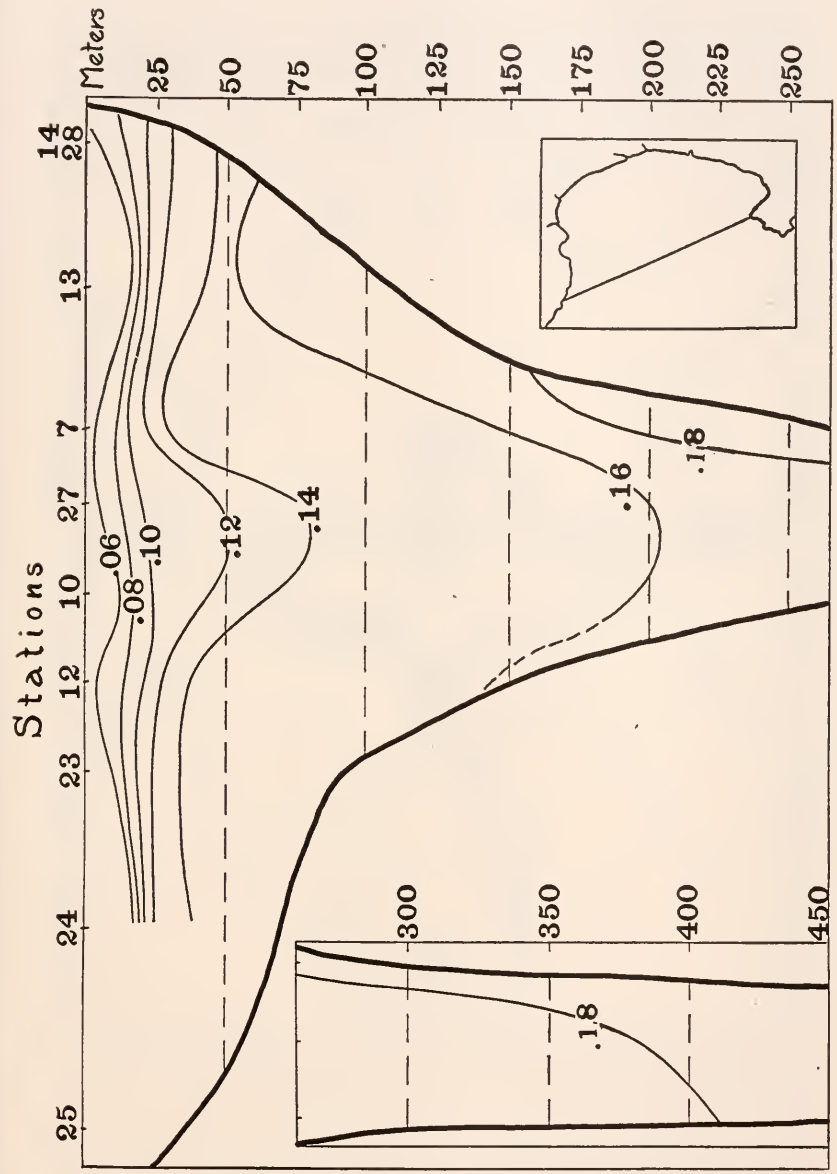

Fig. 31.— Profile across the mouth of the bay for phosphates (in milligrams per liter of P_4O_5).

Nitrate

For technical reasons, explained on page 432, the determinations for nitrates were not only less numerous than those for silicates and

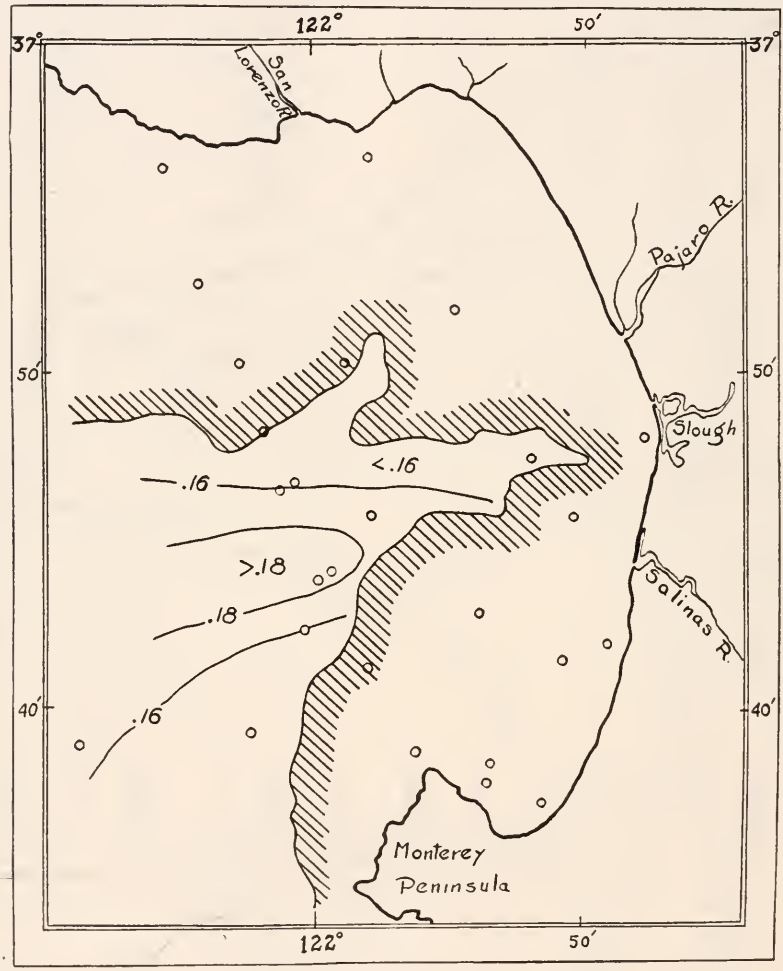

FIG. 32.— Distribution of phosphates (in milligrams per liter of P_2O_5) at a depth of 200 meters.

phosphates, but less satisfactory. Consequently it is not wise to draw conclusions from station to station differences, unless these show

regional consistency, are consistent with other chemical features of the water, or are consistent with the regional abundance of diatoms or of peridinians.

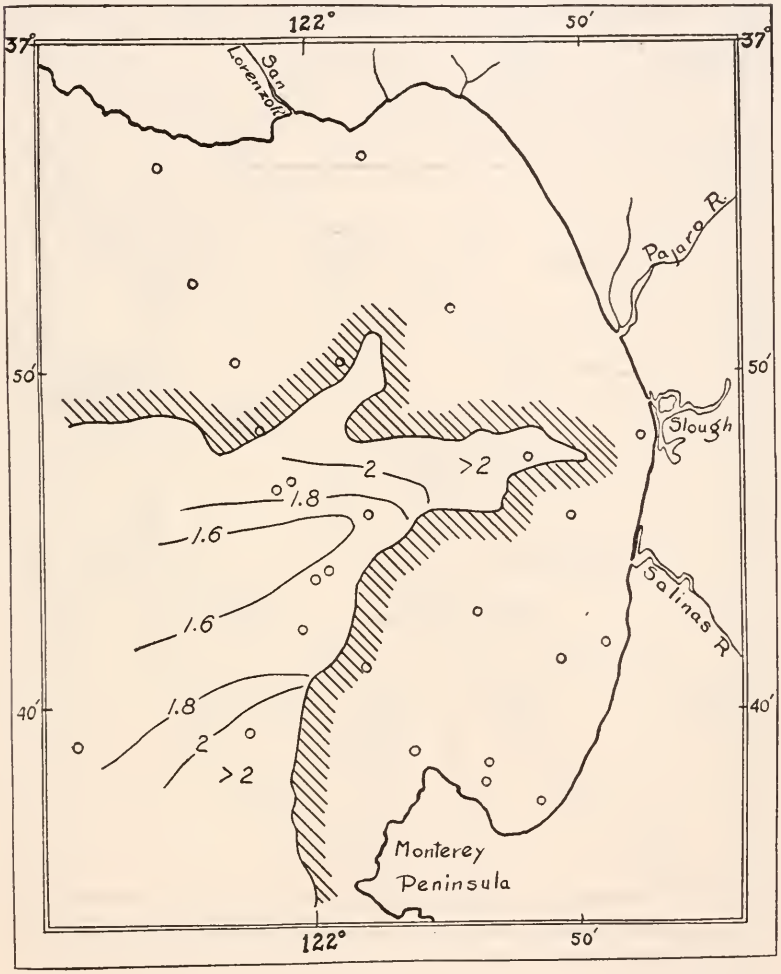

FIG. 33.— Distribution of silicates (in milligrams per liter of SiO_2) at a depth of 200 meters.

The most interesting aspect of the nitrates at the surface is that at three stations we found the surface water wholly nitrate-free (Sta-

tions 21, 22, 23, Fig. 34), whereas measurable amounts of silicates and of phosphates were detected at every station. But as no sub-

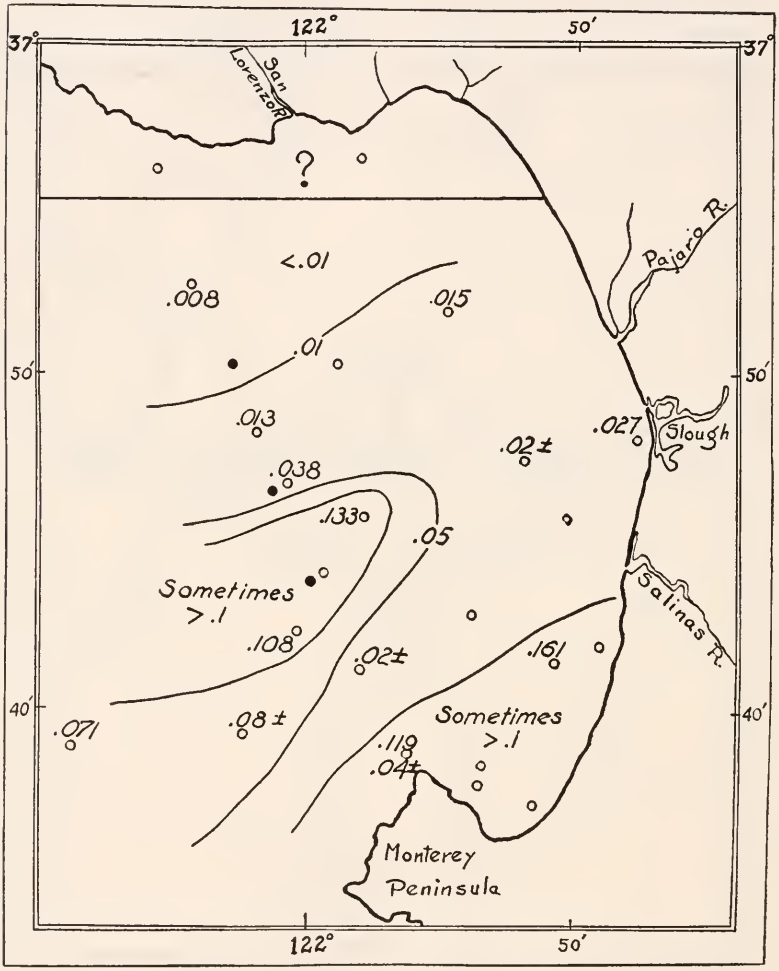

Fig. 34.— Distribution of nitrates (in milligrams per liter of NO_3) at the surface. Heavy dots, nitrate-free.

surface data for nitrates are available for these particular stations, we cannot state how thick the nitrate-free stratum may have been. The vertical distribution of nitrates, at the few localities where serial

observations were made, showed considerable variation from station to station in the upper 25 meters. Thus two stations (12, 17) showed a continuous increase downward to that level, whereas at three others,

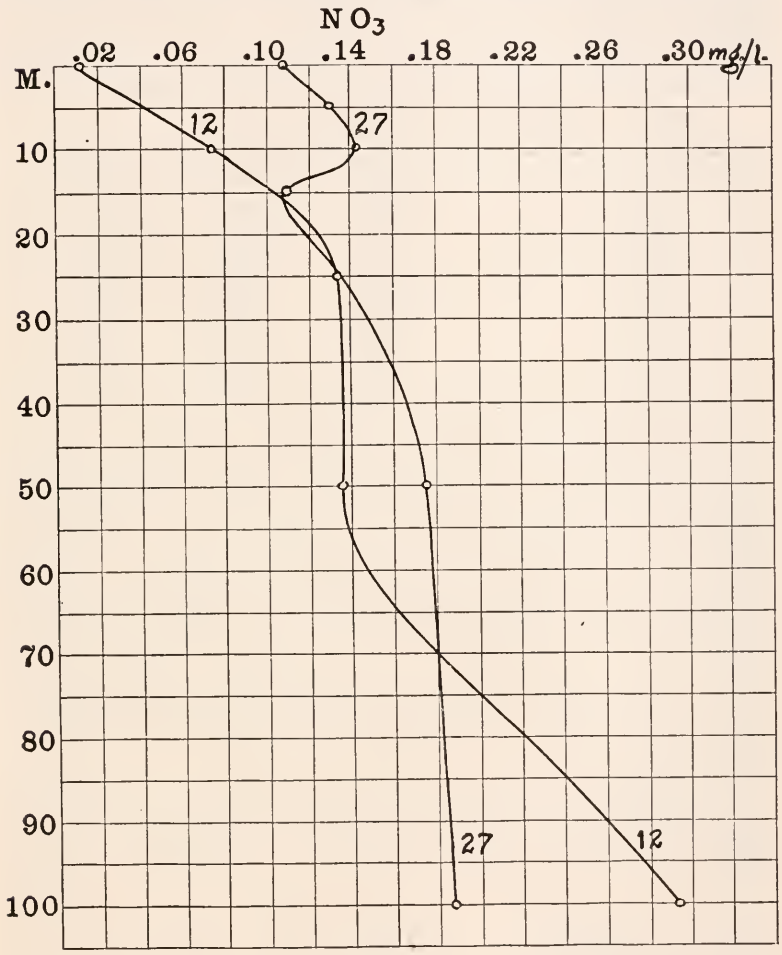

FIG. 35.—Vertical distribution of nitrates (in milligrams per liter of NO_3) at Stations 12 and 27.

one deep and two shoal (24, 27, 28), a comparatively rich stratum at 5–10 meters was sandwiched in between poorer waters, both at the surface and deeper (Fig. 35). This alternation was so pronounced

in these instances that it appears also for the average values for the levels in question, as tabulated below. And while it characterized only three of the stations, with no definite regional segregation, it deserves attention because it was not paralleled either by silicates or by phosphates.

NO_3 Nitrate, mg. per liter

Depth meters	No. of samples	Maximum	Minimum	Mean
surface	9	.161	.00	.047
5	3	.161	.013	.101
10	4	.141	.038	.097
15	3	.108	.021	.074
25	5	.174	.136	.152
50	7	.178	.136	.169
100	4	.292	.174	.209
200	2	.197	.158	.178
600	3	.266	.251	2.60

In general, and for the area as a whole, the concentration of nitrates may be described as increasing with depth, at the time, from the 25 meter level downward to the deepest level reached (600 meters); and in every case the 50 to 100 meter stratum proved considerably richer in nitrates than did the superficial 10 meters of water. Two stations (24 and 27), it is true, offered apparent exceptions to this progressive enrichment with depth, the recorded values suggesting slightly less nitrate at 70 meters than at 150 in the one case, slightly less at 200 meters than at 100 in the other. But in both these instances the apparent reversals were hardly greater than might result if the experimental error chanced to be cumulative, hence they need not be discussed further.

We must point out, however, that while the 600 meter level showed a considerably higher value of nitrate than any shoaler level at each of the deep stations (17, 24), the absolute maximum for the whole area (0.292 mg/li) was recorded at a depth of only 100 meters, at a station (12) where the progressive enrichment from the surface downward with increasing depth was so orderly that there was no probability of any considerable error in the determinations. As this value is not only considerably higher than any other recorded in Monterey Bay at an equal depth, but considerably higher even than the values encountered 500 meters deeper, the most rational explanation is some local source of enrichment (p. 507). However this may be, one exceptional value

does not interfere with the generalization that at every station deeper than 100 meters the bottom water averaged at least five times richer than the surface in nitrates. Thus for nitrates, as for phosphates and silicates, the water of the deeps off the mouth of the bay, and in the trough of the latter, contained a store which, if it seems small by absolute standards, was extremely high by comparison with the poverty of the surface.

2. *Comparison with near-by regions*

Moberg's (1928, p. 512) graphs for summer averages in the upper 150 meters at La Jolla show phosphate values somewhat lower at the surface there (averaging about 0.01 mg/li) than we found in Monterey Bay at the same season (about 0.04). But this difference decreases with depth until at 150 meters the average summer values so far recorded for the two localities are almost precisely alike (0.16 to 0.17 mg/li). In the case of silicates, however, the Monterey values average considerably the higher throughout the entire depth column, the surface mean being only about 0.32 mg/li at La Jolla (0.5 for Monterey Bay); the 50 meter mean 0.64 mg. per liter as against 1.51; the 100 meter mean 0.91 as against 1.77; the 150 mean 1.17 as against 1.8. Furthermore, the La Jolla graph for silicates shows much more irregularity in the upper 30 meters, even for averages, than does the corresponding graph for Monterey Bay (Fig. 28). In spite of these differences, the vertical distribution of silicates was essentially of the one type at these two localities, the water averaging 3.6 to 3.7 times as rich at 150 meters as at the surface in each case. And with only one month's data for Monterey Bay, it is doubtful whether the recorded difference represents a normal divergence between the two regions.

No data for phosphates or silicates have yet been published for southern Californian waters for depths greater than 150 meters. But the following values, from unpublished data contributed by the Scripps Institution for two stations about one hundred miles north of La Jolla, August, 1926, show that phosphates continued in about the same amount as off Monterey in July, 1928, but silicates lower, down to 600 meters:

Depth	Phosphates P_2O_5 Mg. per liter	Silicates SiO_2 Mg. per liter
200	.175	1.76
400	.200	2.23
600	.221	2.68
1000	.264	3.80

The discharge from the Fraser River results in much greater richness in silicates in the partially enclosed waters of the Straits of Georgia, Hutchinson (1929) having recorded values as great as one to four parts (as SiO_2) *per thousand*, contrasting with a maximum of only about 2.41 parts *per million* at Monterey for the same depth zone.

The concentration of phosphates, however, is about the same in the Straits of Georgia as we found it in Monterey Bay, Hutchinson's (1928) graphs showing phosphates varying from 0 to 0.06 milligrams per liter at the surface and from about 0.075 to 0.135 milligrams per liter at 15 meters depth, at selected stations.

The fact that the waters off California show increasing richness in phosphates and silicates, with increasing depth, downward to depths of 500–1000 meters (now amply established) proves that the northeastern Pacific agrees in this respect with the north and south Atlantic (Atkins and Harvey, 1925; Atkins, 1923–1926; Harvey, 1928; Wattenberg, 1927). This, therefore, may be accepted as the state prevailing throughout all the ocean basins. The actual values reported for the 500–1000 meter stratum, by recent methods, have also been of about the same general orders of magnitude, wherever measured.

The summer values recorded by Moberg (1928) for La Jolla, compared with our data, suggest that in summer Monterey Bay waters are considerably the richer in nitrates in the superficial strata, for he found the water off La Jolla practically nitrate-free in the upper 15 meters, and as deep as 30 meters carrying only about 0.05 milligram per liter of nitrates, whereas the surface water at Monterey was only occasionally nitrate-free, and at 30 meters the average concentration was between 0.15 and 0.16 mg/li. But at 50 meters the nitrate values averaged slightly the higher at La Jolla (about 0.18), with the differential in this direction increasing with increasing depth until at 150 meters the La Jolla average (about 0.33) was about 0.14 mg/li the higher. Even if the maximum Monterey values be taken for the comparison, La Jolla water at this depth showed a surplus of about 0.085 mg/li. The vertical gradient, as graphed by Moberg (1928, p. 512) suggests still more difference between the two localities at greater depths. In short such data as are yet at hand point to a much richer store of nitrates in the deeps off La Jolla than off Monterey Bay. The relative states are not so clear for the surface waters, for while the recorded differences may seem considerable, we might have found a more consistent depletion of the surface stratum with regard to nitrates if we had studied the bay a few weeks earlier or a few weeks later, or in another summer.

It is interesting that the nitrate values of Monterey Bay at 100–600 meters, differed little from those recorded for that depth zone off Ireland, by Harvey (1928a).

3. *Maintenance of chemical fertility in Monterey Bay waters*

Successive determinations of the amounts of nutritive chemicals (using this term in a broad sense) in solution in sea water have shown so general a correspondence between their changes in richness, and the fluctuating abundance of planktonic plants, that depletion of one or another nutrient substance, or group of substances, seems, on the whole, the factor that most effectively limits plant production in the sea.[1] Opportunities to examine the means by which the drafts upon such substances as phosphates, silicates and nitrates are made good are therefore welcome, especially any opportunity to determine the relative importance, for given regions, of the overturn of matter within the sea itself, as compared with the materials contributed by rivers and land-wash in general.

Upwelling as the chief agent

Monterey Bay offers an exceptional opportunity for studies in this field, both because the governing type of circulation there brings water up from below, and because the contribution of salts made by tributary rivers is concentrated within so short a part of the year that its direct effect, at other seasons, can be looked on as negligible (p. 510). It also offers an opportunity to compare the state prevailing in a sector typically oceanic, controlled by upwellings from the deeps, with the conditions existing in enclosed waters in the same general region, where river waters play a leading part — Puget Sound, for example (Hutchinson, 1928), and San Francisco Bay (Miller, Ramage and Lazier, 1928); as well as with the North Sea and English Channel, made classic in this respect by the pioneer studies of Brandt, Raben, Atkins, and others.

Since consumption of these nutrient salts by plants, in their photosynthesis, is necessarily confined to the superficial stratum, where sunlight penetrates with intensity sufficient to afford the requisite energy, and since animals (so far as yet established) cannot, as a group, make use of these simple chemicals directly (we make no critique here of Pütter's theory), oceanographers have come to regard

[1] For a recent quantitative presentation of this thesis, see Atkins, 1926a.

the upper 40 meters or so as the zone of chief consumption in the sea. On the other hand the deep waters of the English Channel, of the north and south Atlantic (Atkins, 1923, 1925, 1926b, Wattenburg, 1927), and latterly of the Pacific (Moberg, 1928) have been found so generally rich in phosphates, etc., as to show that everywhere, over the open oceans, and even in shoaler regions, the bottom waters are a reservoir for plant nutrients, needing only some mechanism to bring the latter up to the photosynthetic zone. Recent studies have thus substantiated Nathanssohn's (1906) early realization of the rôle played by upwelling currents in maintaining oceanic fertility.

A glance at the graphs for the average amounts of silicates, phosphates and nitrates at different depths (Figs. 28, 35) is enough to show that in July, 1928, Monterey Bay and its offing formed no exception to this rule, but that the deep water held in solution an abundance of all these substances. Neither is there any reason to suppose that the abyssal water off the Californian coast is less rich at any other time of year, or that the years 1926 (for La Jolla)and 1928 (for Monterey) were exceptional years in this respect.

The fact that upwelling proceeds constantly enough, rapidly enough, and in sufficient volume in the Monterey sector, to depress the midsummer temperature of the surface water some 8° below the value to which solar warming would otherwise bring it (p. 476), were it not frequently replaced by colder water from below, gives some picture of the parallel efficiency of this same updraft in bringing up water that (as has been found) is richly stocked with the substances in question. In brief, present indications are that Monterey Bay is an especially favored location so far as replenishment of the surface water is concerned — hence potentially an exceptionally rich region for the production of planktonic plants. It is only because of events taking place in the uppermost stratum, namely absorption of solar heat and consumption of chemicals by plants, that upwelling fails to keep the whole column of water off Monterey Bay homogeneous from top to bottom.

The prevalence of a type of circulation best fitted to bring up rich water from below is, however, but one side of the fertility-picture: another involves the sources from which the deep water becomes stocked with nitrates, silicates and phosphates and other solutes; likewise the localities where replenishment of this sort proceeds the most rapidly. Up to date, detailed information, as to this general question, has been scanty for any particular region, though it is evident that such restocking of the bottom water, as contrasted with

the surface, results from the decomposition of carcasses, and by the solution of their shells, possibly also from nitrogen fixation by bacteria.[1]

In interpreting the differences that we found in the deeps off Monterey between the regional distribution of temperature, and that of the few chemicals for which the local waters have yet been tested, it is necessary to bear in mind that the two classes of phenomena are governed by different factors, though in many respects parallel. The low temperature of the abyssal water is directly reminiscent of the sinking from the surface of cold water at some far distant station, subarctic or subantarctic. But wherever animals or plants, sinking down, rot in the deeps or on the bottom, enrichment of the water with compounds of phosphorus and nitrogen results—with compounds of silicia also if their shells or skeletons are siliceous.

Thus while the floor of the sea, however deep, is not a cooling agent *per se*, it is a most effective agent for the chemical enrichment of the water. A certain amount of enrichment of the bottom water must take place everywhere on the sea floor, unless both the latter, and the overlying waters as well, be barren of life, though in shoal waters consumption from above may outstrip this enrichment from below, bringing progressive depletion as the end result. Thus as bottom water, in depths below the zone of photosynthesis, drifts along over the floor of the sea, the tendency is for it to gather a greater and greater load of solutes, the rapidity with which this happens depending upon the amount of organic decomposition that takes place, quite independent of the depth. Movement over the sea floor, or temporary isolation in the deeps, have, on the contrary, very little effect on the temperature of the water if the depths be so great (or the situation such) that vertical stirrings are negligible.

It is possible that the richness of the deep waters off California, in silicates, phosphates and nitrates chiefly reflects substances taken into solution at lesser depths in the sub-Antarctic, or sub-Arctic, plus the added load picked up, en route in its oblique drift across the Pacific; or it may result chiefly from organic decomposition taking place over the Pacific slope of North America. However this may be, the comparative uniformity of the 600 meter level with respect to phosphates and nitrates along the Monterey front, is an indication that there was no one specially rich focus of local enrichment at the time of our investigations, at what was then apparently the base-

[1] The restocking of the superficial stratum that takes place, direct, from land drainage, and by absorption of ammonia from the atmosphere is another question.

level for active upwelling. The case seems to have been different for silicates, because it is hard to explain the banking of silica-rich water against the northern slope of the trough, at 500–600 meters except on the assumption that some process of enrichment was locally at work there for silicates, that was not effective for phosphates or for nitrates. The fact that in the deep strata, from 200 meters downward, enrichment in silicates averaged more rapid, with increasing depth, than for phosphates, though the curves for these two substances were parallel in lesser depths (p. 486), points in this same direction.

Our profiles for silicates and phosphates (Figs. 30, 31), and the isobathic projections for the higher values of each (Figs. 36–38), so closely parallel the corresponding projections for temperature, especially in revealing a banking up of the higher values around the slopes of the trough, as to show that upwelling was in fact bringing rich water upward there at the time, in the mid depths. But in the superficial stratum the water richest in phosphates and silicates (Figs. 39, 40) like the coldest (p. 435, Fig. 2) then rose nearest the surface over the mouth of the trough, as might have been expected from the distribution of temperature and salinity.

When the shoaler strata are examined in detail, suggestive differences appear between the chemical factors and the temperature, for the angle of obliquity was steeper for silicates in the zone between the 70 meter and 200 meter levels, than for the isothermobaths (Figs. 17, 19, 20). For example, water of a temperature (8.2°–8.5°) that prevailed at 200 meters in the axis of the trough near its mouth was at the time flooding the slope up to the 120–100 meter level. But silicates of the value prevailing at that same depth in the trough (1.6 mg/li) also bathed the bottom over most of the shoal parts of the bay, to the north of the deep trough as well as to the south (Fig. 37). While the distribution of phosphates agreed more nearly with temperature in this respect in the northern side, the banking up of phosphate-rich water more nearly paralleled that of silicates in the southern (cf. Figs. 30 and 31 with Fig. 7, curves for 8.5° and 9° temperature, 0.16 mg. per liter P_2O_5, and 1.6 mg. per liter SiO_2). Interpretation of the state of the superficial waters is obscured by the danger of confusing periodic variations with regional differences. But the contrast between silicates and temperature is so wide in this respect that it remains to be accounted for, after all reasonable allowance has been made for the time factor, and for possible errors in the determinations.

If temperatures and salinities can be taken as safe indices to the loci of most active upwelling, as seems justifiable, the most reasonable

explanation for differences of this sort between the physical and chemical states of the water of the bay is that while the only source

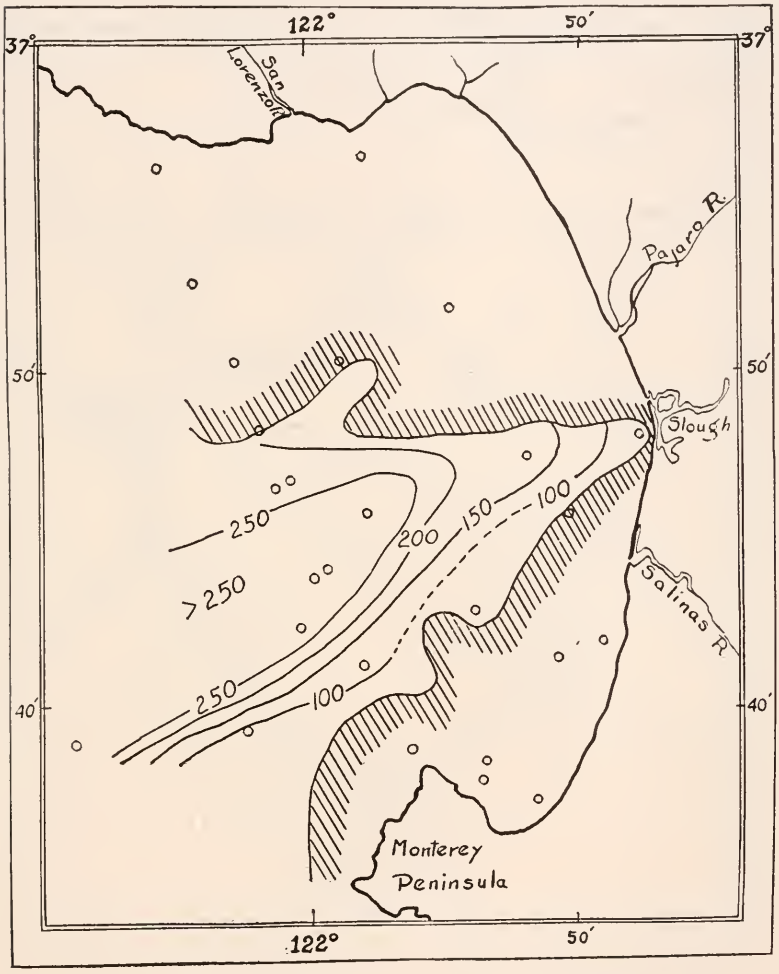

Fig. 36.— Depth below the surface of the layer of 2 milligrams of SiO_2 per liter.

for low temperature, at the place and season, was the underlying deeps, the upwelling water was further enriched as to silicates and phosphates as it spread over the upper slopes of the bay. Such a

thesis needs no special defence, for this is what is to be expected. What is interesting, in the present case, is the strong indication that local

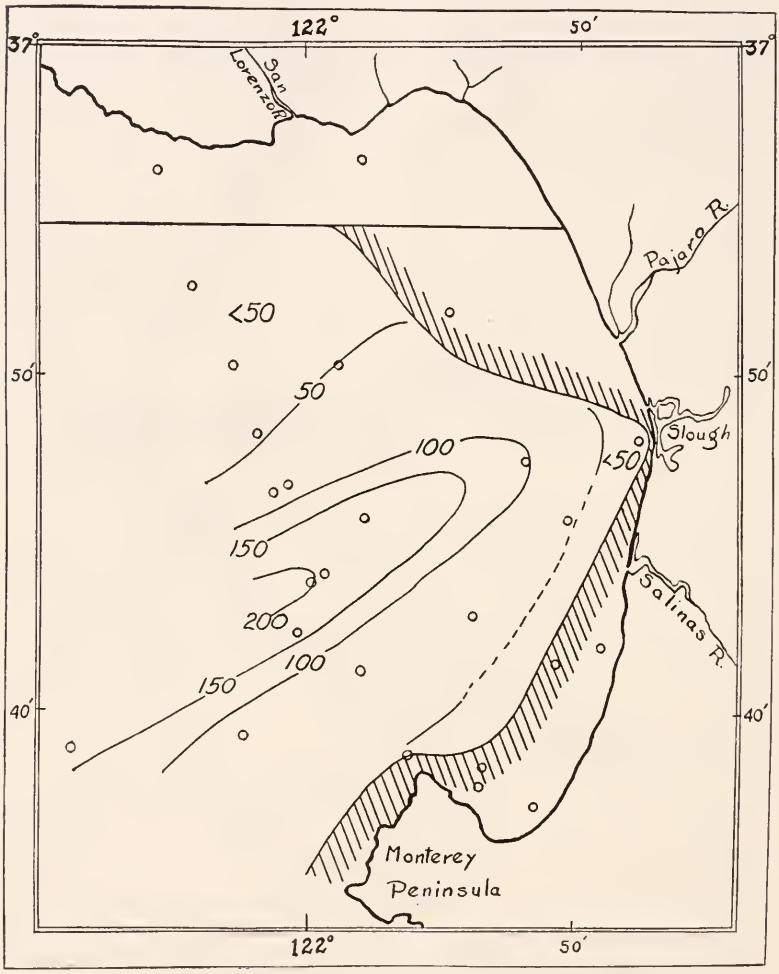

Fig. 37.— Depth below the surface of the layer of 1.6 milligrams of SiO_2 per liter.

solution of the chemicals in question, in depths less than 200 meters, may vie in importance with the deep reservoirs as a source of replenishment for the photosynthetic zone in this partieular location. Conse-

quently, in interpreting events at the surface of the bay, it is necessary to take into account not only the mass upwellings, but equally any

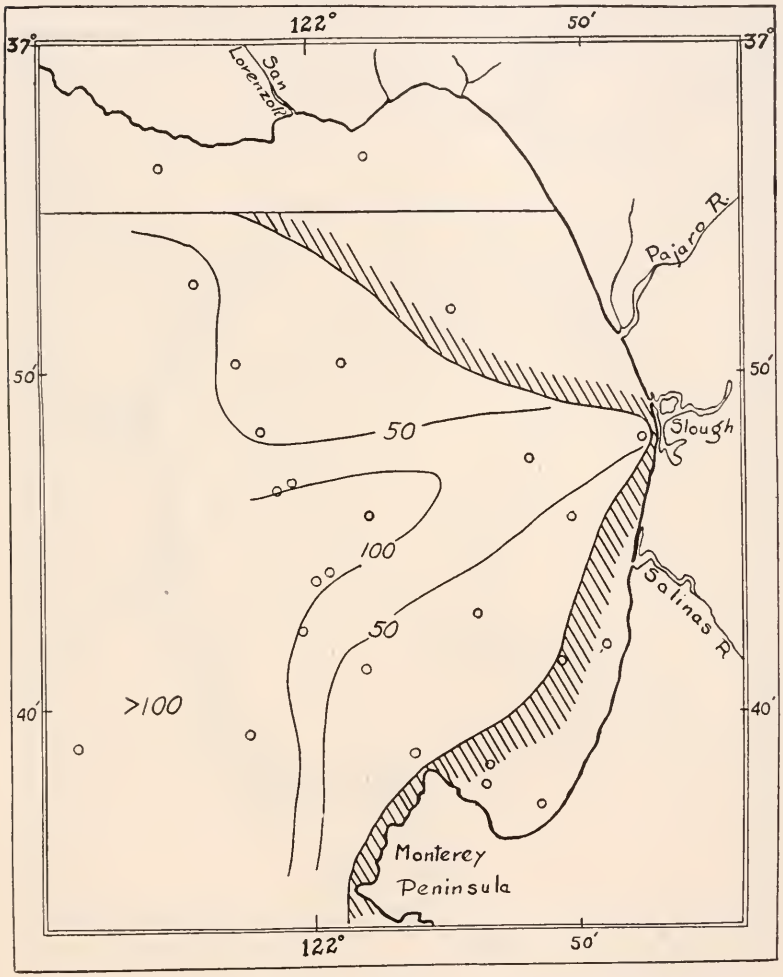

FIG. 38.— Depth below the surface of the layer of .15 milligram P_2O_5 per liter.

vertical movements that might bring water up from depths of 100–200 meters. Shoal bottom may therefore be an important factor in the maintenance of chemical fertility in Monterey Bay, though not to the

extent that it is in regions (e.g., north Atlantic) where the continental shelf is wide.

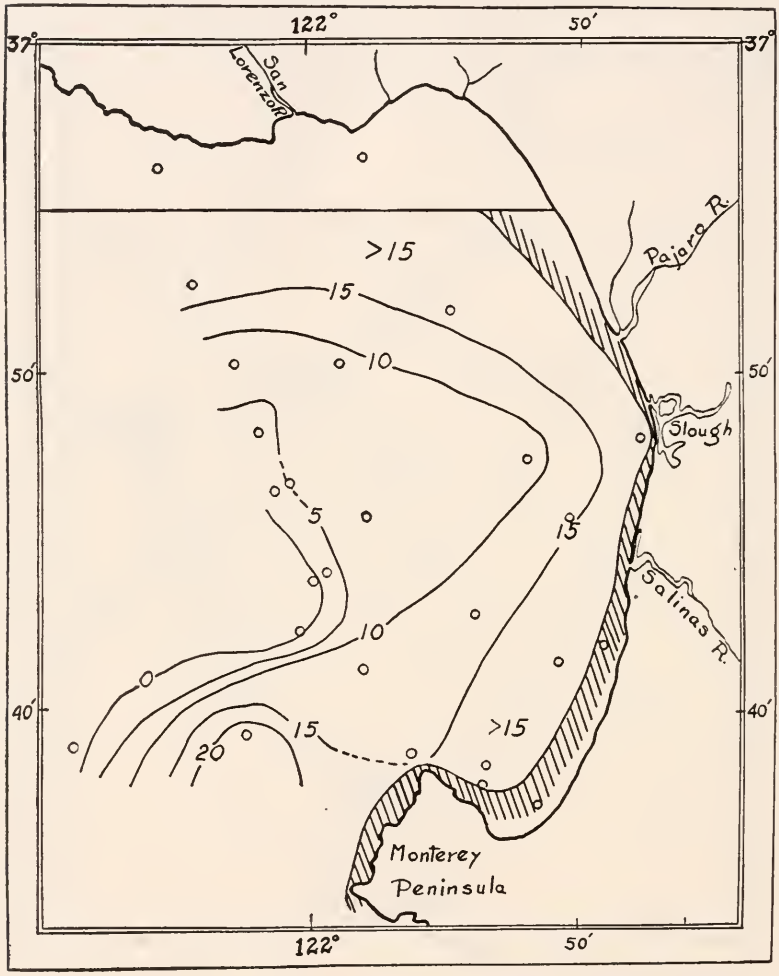

Fig. 39.— Depth below the surface of the layer of .05 milligram P_2O_5 per liter.

As already stated (p. 452), the amount of river water that enters the bay at the season of our survey, or for the five months previous, is negligible. But the discharge from the Salinas River, as well as from

the other tributary streams, is so large during the months from November to February (p. 452; Van Winkle and Eaton, 1910) that this

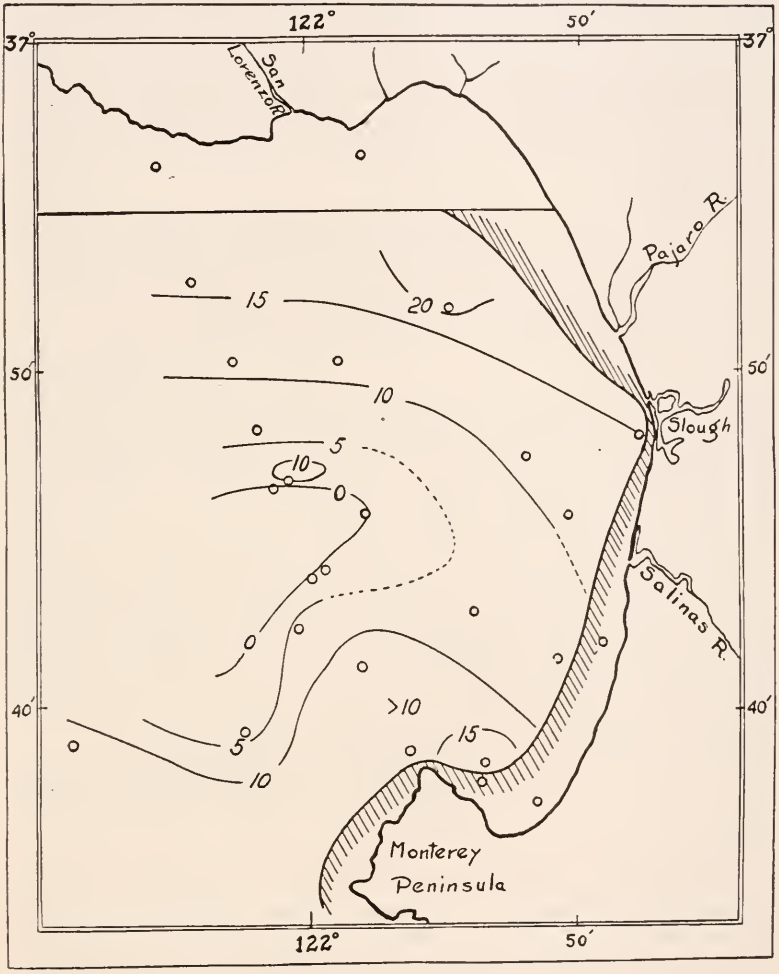

FIG. 40.— Depth below the surface of the layer of .6 milligram of SiO_2 per liter.

source of supply must also be taken into account in any year-round study of the bay. A sample taken just within the mouth of the Salinas on July 24, 1928, showed 12.82 mg. of silicates (SiO_2) per liter, while

Van Winkle and Eaton (1910) report 25 mg. per liter in August, 28 mg. per liter [1] in April, at a point a few miles upstream, with values of the same general order of magnitude for the San Lorenzo and the Pajaro, two smaller streams tributary to the bay, (19–33 mg. per li., and 15–32, respectively). Thus the river water that discharges into the bay is about twenty times as rich in silicates as we found the upper stratum of the latter to be in summer. But most of this contribution enters the bay so early in the year that by midsummer we could detect no regional evidence of it.

Replenishment as to silicates also takes place constantly, wherever diatom cells are dying and their shells dissolving. And the fragility of most of the latter, their lightness, and the relatively high solubility of this particular form of silica, probably results in more rapid solution within the photosynthetic zone than is generally appreciated.

Moberg (1928) has already emphasized the efficacy of this process, suggesting that the regular increase in silicates that he found with depth, at La Jolla, may be maintained by the solution of shells of dead diatoms as they sink. It is even possible that after a mass production of diatoms, the upper stratum of water may dissolve silicates from their dead shells rapidly enough to more than renew the store there, without accessions from the deeper waters.

This, in fact, seems the most reasonable explanation for the enrichment of the water by silicates that took place locally, near Point Pinos, from July 16th (0.337 mg/li of SiO_2 at the surface) to the 23d (0.71 mg/li) for the numbers of diatoms present at the surface there decreased meanwhile from 390,000 cells per liter to about 9,000, while temperatures and salinities (p. 475) show that this was a period of comparative quiescence, so far as upwelling was concerned.

No determinations have been made of the phosphates in the waters emptying into the bay at the season when their discharge is large. (We found 0.34 mg/li of P_2O_5 just within the mouth of the Salinas on July 24, 1928.)

According to the determinations reported by Van Winkle and Eaton, the Salinas River, both in April and in August is about ten times as rich in nitrates (1–1.3 parts per million of NO_3) as we found the water of the bay. Whether this appreciably enriches the latter during the season of discharge, or whether it is largely consumed within the mouth of the river or close by, as happens in summer in some localities (Harvey, 1928) is a problem for the future.

[1] Reported as parts per million.

Depletion of the upper strata

It is certain that in different regions, or at different times of year in the same region, different chemical solutes may be the limiting factors for plant production. This is reflected in the fact that students working in various localities, by various methods, have decided first that one, then that another substance is responsible. Thus, to quote only two instances,[1] Atkins (1926b) found the surface of the English Channel entirely depleted of phosphates at the time of mass production of diatoms. But in southern California coast waters Moberg (1928) found the surface stratum entirely denuded of nitrates, though containing measurable amounts of phosphates.

It is equally proven — both by observation at sea and by cultural experiments — that different groups of planktonic plants, and even different species within a given group, may differ widely in their cultural requirements.

Analogy with other parts of the sea indicates that in July, 1928, phosphates were present in sufficient amount at every station in Monterey Bay, and at all depths, to support an abundant planktonic flora, except locally, right at the surface. Thus means of about 0.04 milligram of phosphates per liter at the surface, 0.06 at 10 meters, and 0.14 at 50 meters, correspond closely with values of 0.025 to 0.039 mg. per liter between the surface and 70 meters, reported by Atkins (1928) for the English Channel, off Plymouth, in late winter and early spring. Similarly, Marshall and Orr (1927) report maximum values of about 0.05 mg. of phosphates per liter at the surface and at 20 meters in the Clyde sea area, in winter; while at La Jolla, Moberg (1928) found diatoms most abundant in water equally rich in phosphates. Hence, a concentration of about this order satisfies the phosphate requirements of planktonic diatoms as a group, although much higher values have been found in certain enclosed waters.

It also seems certain that the waters off Monterey were sufficiently stocked with silicates at all depths in July, 1928, to support an abundant stock of diatoms. Thus the mean surface value (0.4 mg. per liter) was somewhat higher than the annual maximum for the English Channel (between 0.2 and 0.3 mg. per liter), and almost equaled the yearly maximum for Plymouth Sound (Atkins, 1926, 1928), regions which, later in the year, support diatoms in abundance. Moberg (1928) also found diatoms most abundant in water of about this same silica content.

[1] The literature in this field is rapidly growing to formidable dimensions: for a recent résumé, see Harvey, (1928).

Much higher values have been reported in the Baltic (Brandt, 1920), in the Gulf of Maine (Bigelow, 1926; Wells 1922); and recently in the Straits of Georgia (Hutchinson, 1928). But, so far as diatom requirements are concerned, present indications are that silicates richer than 0.4–0.5 mg. per liter are in excess, unless all other required nutrients are also present in much greater richness than is normally the case in the open sea.

It is obvious that at the stations in Monterey Bay where the surface was nitrate-free, it could not be fertile for plants of any sort. Unfortunately no plankton counts were made for these particular stations. However, at the surface stations where nitrate was found, the mean value (0.05 mg. per liter) was about that found by Moberg (1928) at the depth (30 to 35 meters) supporting the greatest number of diatoms off La Jolla, while the mean for Monterey Bay at 5 meters (0.1 mg. per liter) about equals the yearly maximum reported by Harvey (1928, 1928a) for the English Channel.[1]

The preceding leads to the general conclusion that in July, 1928, the upper 10 meters of the bay were amply stocked with the three nutrients (phosphates, silicates and nitrates) to support active growth of diatoms, except locally, right at the surface, where depletion of nitrates had taken place.

Periodic surveys alone can show how uniformly upwelling maintains this relatively high degree of fertility from season to season, against the constant depletion by plants. But with the underlying water so well stocked with the three nutrients whose scarcity seems (by present knowledge) to be most apt to limit plant production, and with the mechanism for renewal from below working so actively (p. 475), Monterey waters are probably rich the year round.

From the standpoint of organic production, irregularities in the richness of the surface water in nitrates, phosphates and silicates are especially suggestive, in a region where upwelling brings renewals at least frequently from below, for a relatively low value for any of these, at a given locality, overlying much richer water, is explicable only on the basis of consumption by plants, unless land water, barren of these chemicals, be diluting the surface stratum at the time.

When the number of diatoms present per liter of water in the bay in July, 1928, is plotted against the values for silicates, phosphates and nitrates, it is evident, not only that the vertical distribution of the two sets of curves shows an inverse relationship (cf. Figs. 28 and

[1] He had considerably higher values in Plymouth Sound.

41), but that whenever diatoms were present in large numbers, the surface water was relatively poor in silicates and phosphates (Fig. 41).

In some cases the converse was true, i.e., rich water where diatoms were scarce — but not always. And at stations where only small numbers of diatoms were found in water poor in nutritive salts, it is

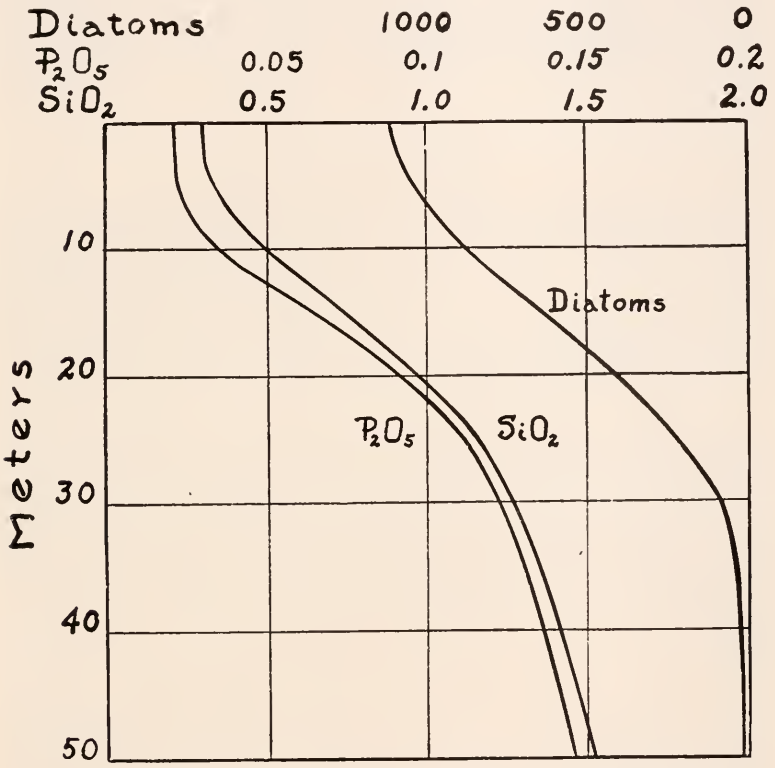

FIG. 41.— Vertical distribution of mean values for phosphates (P_2O_5) and silicates (SiO_2), in milligrams per liter, and of average number of diatom cells in thousands per liter, in the upper 50 meters, at Stations 7, 10, 12, 13,15, 16, 18, 19, and 24.

probable that the data were obtained so soon after the termination of abundant production, that enough time had not yet elapsed for upwelling to have again enriched the devastated area.

B. Oxygen

Investigation of the dissolved oxygen was not undertaken until the last few days of the survey, consequently it is impossible to follow some of the interesting problems suggested by the determined values; such, for example, as the boundaries of oxygen-poor water within the bay; the reason for the poverty of the midstratum in oxygen; the extent and degree of supersaturation in the surface stratum of the bay, and the efficiency of surf and of turbulence as local agencies of aeration.

1. *Monterey Bay in July, 1928*

The observations consisted of two vertical series, one in deep, the other in shoal water, and of a number of surface samples in various parts of the bay. These last were numerous enough and distributed generally enough to show that the surface water contained from 5.20 cc. to 7.33 cc. of oxygen per liter, which, at the temperatures of the individual stations *in situ* is from 85.9% to 124.5% saturated.

A series of samples taken at three-mile intervals, along a line running from headland to headland, on July 20, showed a definite gradation, both as to absolute amounts of oxygen, and as to the percentage of saturation, from a minimum over the mouth of the submarine valley in the central parts of the bay, to maxima next the northern and southern shores (Fig. 42). The two samples that yielded the minimum value of 5.20 cc. per liter over the trough (Station 29), and the maximum of 7.33 cc. per liter over shoal water (Station 31) were in agreement with the rest of the picture, although collected four days later.

To find so wide and definite a regional variation within so small an area was unexpected, for when in equilibrium with the atmosphere the surface of the sea is close to saturation with oxygen (95–105% saturated, allowing for the lag in adjusting to changes in temperature).

The quantities of oxygen in the surface water of Monterey Bay exceeded these normal limits so widely in both directions as to make the cause for this difference a matter of some interest.

Upwelling offers a ready explanation for a poverty of oxygen at the surface there, as it does for so many other oceanographic phenomena along the California coast, because the two vertical series revealed a rapid decrease in the oxygen content of the water with increasing depth, as follows:

	Station 20		Station 29		Mean	
	cc/li	% sat.	cc/li	% sat.	cc/li	% sat.
Surf	6.63	111.5	5.20	85.7	5.93	99
25 M.	2.99	45	4.00	64	3.49	55
50 M.	2.57	39	3.5	55	3.02	47
100 M.			2.46	38	2.49	38
250 M.			1.49	22	1.49	22
500 M.			0.63	9	0.63	9

Furthermore, the table shows that a considerable regional difference existed at the time in the rate of depletion of oxygen with depth, subsurface values being considerably lower at the station where the water was only about 90 meters deep, than over the trough, although the relationship was the reverse at the surface. In fact, the oxygen content at the shoal station was nearly as low at the 25 meter level as at 100 meters at the deep station.

The ways in which ocean waters are either enriched with oxygen, or denuded, and the levels in the sea at which these opposing processes chiefly work are so well understood that no discussion of them is needed here.[1]

The fact that the thickness of the oxygen-rich stratum off Monterey closely parallels the vertical abundance of diatoms is evidence that photosynthesis was the most effective local agent of oxygen replenishment there at the time, as indeed might have been surmised from the type of vertical circulation prevailing. More direct evidence to this effect is the fact that the highest oxygen values were recorded when diatom counts also averaged high (>800,000 per liter, compare Fig. 42 with Fig. 43). But no closer parallel can be drawn, because some of the individual stations where oxygen values were low yielded many diatoms, and vice versa.

A cursory observation of the active mixture of air with water that is caused around the rocky coast line of the Monterey peninsula by the heavy surf makes it an interesting question how effective this local agency for aeration is for the bay in general. But our observations were not sufficiently intensive to throw light on this point.

Wattenberg (1929) has already called attention to the fact that the lower boundary of the surface stratum rich in oxygen in the tropical Atlantic corresponds to the transition zone of density, as evidence of the depth to which turbulence carries oxygen down from the surface.

[1] See, especially, Wattenberg's (1929) discussion of the aëration of the Atlantic; and for an excellent bibliography of oxygen in sea water, Gaarder (1915.)

A similar parallelism obtains between these two classes of phenomena off Monterey, in this case rapid decrease in oxygen with depth ac-

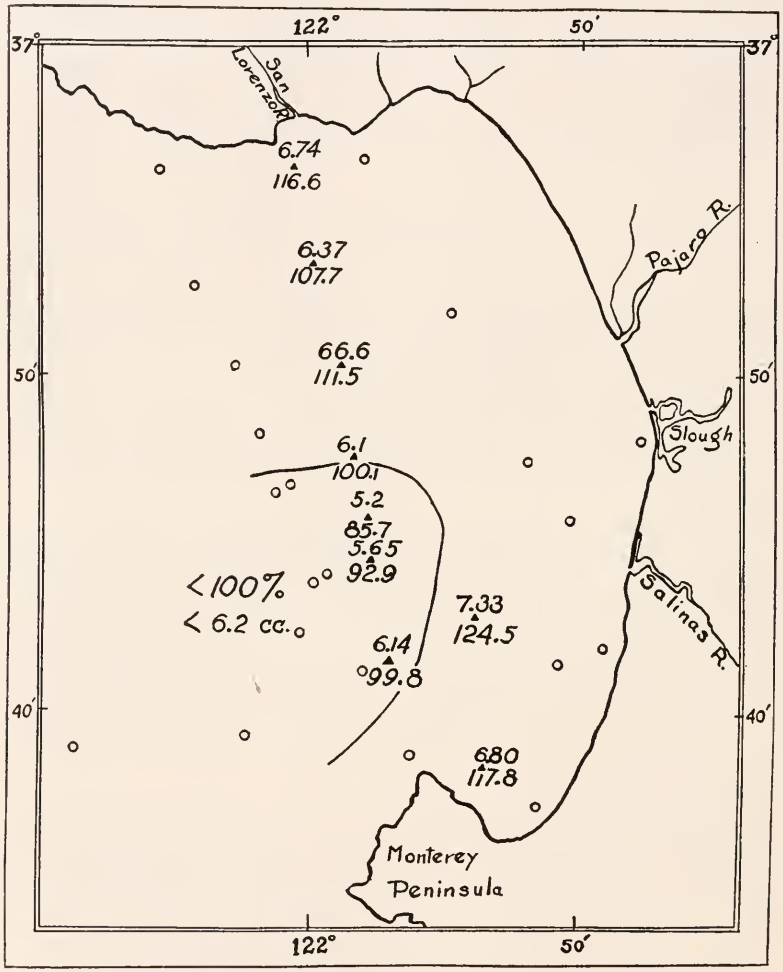

FIG. 42.— Oxygen at the surface, in cubic centimeters per liter (upper figures) and in per cent of saturation (lower figures).

companying the vertical stability indicated by a vertical increase in the specific gravity of the water.

This is further evidence that the presence of water poor in oxygen so near the surface off California is one of the striking manifestations

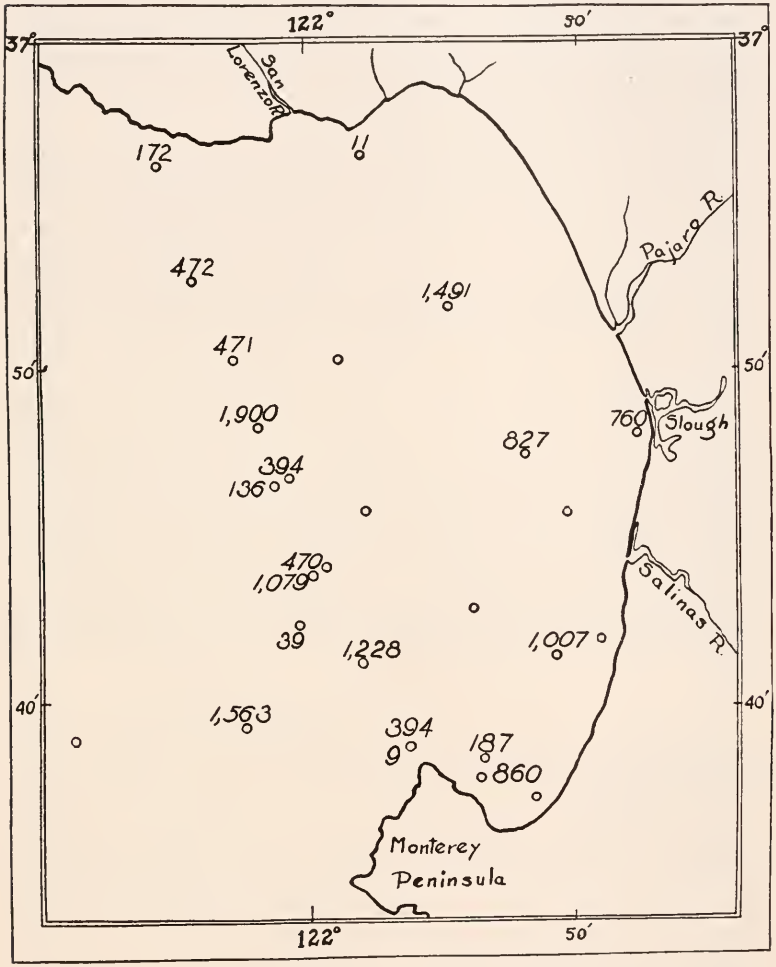

FIG. 43.— Numbers of diatom cells (good and bad condition combined) at the surface, in thousands per liter.

of the upwelling circulation active there. Apparently this circulatory agency prevents the processes of enrichment by absorption of air at the surface, and by photosynthetic action of plants from saturating

or even supersaturating the water there to the considerable depths to which this often happens in other seas, for there is no reason to suppose that the values we found, in July, 1928, represented any unusual condition. Thus, off Monterey, the average percentage of saturation at 25 meters was only 64, while off La Jolla (Leslie and Moberg, 1930), where upwelling is not so active, the upper 40 meters carried nearly a full load of oxygen.

By this reasoning, the oxygen-rich surface stratum should not only be thinnest where upwelling water is in greatest amount, but the actual surface values smallest there. Our observations satisfy the second of these criteria, witness the regional correspondence between temperatures and oxygen at the surface (Figs. 2, 42). And satisfaction of the first-named criterion is indicated by the fact that the station where vertical cooling, with depth, was the more rapid (Station 20), also showed the more rapid decrease in oxygen from the surface downward.

Conceivably, upwelling might take place so rapidly, and in such volume, off California, and so greatly outstrip the regenerative processes there, as to bring to the surface water practically free from oxygen. But the abundance and variety of the littoral fish fauna, and especially the abundance of the local species of clupeids and engraulids makes it unlikely that this ever happens on a broad scale, though the possibility of ecologic disaster of this sort is ever-present where the vertical distribution of oxygen, and the prevailing vertical circulation are of the type characteristic of the ocean waters along the California coast.

2. *Comparison with other parts of the Pacific*

The Monterey data just stated are especially welcome because few determinations of dissolved oxygen have yet been recorded for other parts of the Pacific.

A few scattered determinations by the "Challenger" (Dittmar, 1884); four vertical series by the "Planet" from the surface down to 1000 meters between latitudes 2° S and 15° N, longitudes 145° E and 129 ° E (Brennecke, 1909); one serial in the Gulf of Panama (Schmidt, 1925); and several serials taken by the Scripps Institution off southern California complete the available list for the open basin of this ocean.[1]

More intensive information has been gathered for enclosed waters, along the Pacific coast of America. Berkeley (1922), Powers (1920),

[1] Collection of water samples for gas analysis is also stated to be included in current oceanographic work in Japan, but so far as we are aware, no data as to the oxygen have yet been published.

and Johnson and Thompson (1929), for example, have made many oxygen determinations in Puget Sound; Miller, Ramage and Lazier (1928) in San Francisco Bay. But such situations as these are not comparable to open ocean waters for obvious reasons.

The serials in the open Pacific have all shown a decided decrease in oxygen, from the surface downward, but with wide regional variation. Values of 0.4–0.6 cc. per liter at 500 meters off Monterey and southern California, but "practically no oxygen at all" at that depth in the Gulf of Panama (Schmidt, 1925, p. 593) indicate that the mid-depths in the eastern side of the North Pacific are poorer in oxygen in the tropics than in higher latitudes, as is the case in the eastern Atlantic (p. 520).

Whether a similar latitudinal gradation also exists in the western side of the Pacific is not yet known. But the fact that the lowest value found there by the "Planet" was 1.62 cc. per liter (or 24% saturated), in latitude 11°36′ N, longitude 128°29′ E, at 400 meters, suggests greater poverty of oxygen in this stratum for the eastern side of the Pacific than for the western.

Neither the Monterey nor the La Jolla serials extended deep enough to show the state of the abyssal water in this respect. However, Schmidt (1925) found oxygen increasing, in the Gulf of Panama, from 500 meters downward to 1000 meters, while the "Challenger" values averaged higher at 3000–5000 meters than at 700–800, indicating the general presence of more oxygen in the bottom water of the central and eastern parts of the North Pacific Basin than in the mid-depths. But the barren mid-stratum certainly extends deeper off California than in the tropics, for the La Jolla determinations showed no increase down to a depth of 1000 meters.

Apparently the vertical distribution of oxygen in the deeper strata is less uniform in type in the western side of the north equatorial Pacific, for three of the seven "Planet" serials deep enough to throw light on this question showed a minimum layer at 200–400 meters, with higher values at greater depths, whereas three others showed a decrease down to 1,000–2,100 meters.

3. *Comparison with the Atlantic*

So far as the oxygen poverty of the midstratum (with higher values near the bottom) is concerned, the eastern North Pacific agrees with the Atlantic — north and south — where recent observations at many localities have shown this to be the general state in low and mid-latitudes (Brennecke, 1909, 1921; Helland-Hansen, 1914; Gaarder,

1927; Wattenberg, 1927a). Greater impoverishment in the eastern side of the Pacific, than in the western, in the subtropical belt, also parallels the Atlantic state, for while the "Meteor" found less than 1 cc. per liter at about 500 meters on the African side, the minimum value on the South American was 4–5 cc. (Wattenberg, 1927a), while Schmidt (1925) reports the water of the Caribbean Sea as 40–50% saturated, at that depth.

Farther north in the Atlantic, however, the east-west distribution seems to be of the reverse order, for the mean values, at 800–900 meters, at 19 "Dana" stations off the southeastern United States out to longitude *ca.* 55° N (lat. 20°–35° N) were close to 3.5 cc. per liter,[1] whereas the "Armauer Hansen" found 4–4.5 cc. per liter (or 62–67% saturation) in the minimum layer at approximately the same depth between Spain, Morocco and the Azores (Gaarder, 1927).

Bilateral comparison, in this respect, can not be extended to higher latitudes in the Atlantic basin, because (so far as we can learn), no serial determinations have yet been made anywhere in the northwestern part of that ocean to the north of latitude 40° N and to the west of longitude 40° W, except in the arctic waters of Baffin Bay (Hjort and Ruud, 1929).

The minimum values in the 200–1000 meter stratum, off Panama, and off California, are decidedly lower than for corresponding latitudes in the Atlantic.

Thus Gaarder (1927) reports no values lower than 4.2 cc. per liter (500–1000 meters) between Spain and the Azores, an amount roughly seven times as great as the minimum we found off Monterey, at about the same latitude. Similarly, the least oxygen found by the "Meteor" in the eastern side of the tropical Atlantic was 0.36 cc. per liter (lat. 15° 24′ S; Wattenberg, 1927a) but the minimum layer in the Gulf of Panama is practically oxygen-free (Schmidt, 1925). Furthermore, such data as are at hand suggest that the midstratum of the eastern side of the North Pacific contains but little more oxygen 35°–40° north of the equator than in the tropics, whereas in the eastern Atlantic the minimum values increase from <1 cc. per liter near the equator, to 4–4.5 cc. at latitude 35°–40° N, and to 5–5.6 cc. at latitude 55°–60° N as shown on Brennecke's (1909, 1921) and Gaarder's (1927) profiles.

Details of the various serials also show that the stratum poorest in oxygen not only reaches deeper down into the Pacific, but that in mid-latitudes low oxygen values are closer to the surface there than

[1] Values calculated from the percentage of saturation and from the temperatures tabulated by Jacobsen (1929, p. 80, table 22).

in the Atlantic. Thus only in the equatorial belt, in the Atlantic, has anything been recorded comparable to the very sharp decline in oxygen values that we found between the surface and the 75 meter level off Monterey, 36°–37° degrees of latitude north of the equator.

The thesis that the poverty in oxygen of the midwater of the oceans is the result of the drafts that have been made thereon by living animals, and by the oxidization of carcasses, since its original aëration near the surface, needs no supporting argument. Wattenberg (1929) credits the greater poverty of the layer of minimum oxygen values in the eastern equatorial Atlantic than in the western to the greater abundance of plankton found by the "Meteor" in that side (Hentschel, 1928). But in estimating the relative regional effect of animal respiration, and of organic decomposition, the larger species of animals, in size from copepods upward, are probably more important than the small species of animals and plants that seem alone to have been included in Hentschel's (1928) estimates. Thus Schmidt (1925) found bathypelagic animals much more abundant in the Gulf of Panama, at the depth where the water was practically oxygen-free, than in the higher oxygen values in the Caribbean. And as nothing whatever is yet known about the proportionate abundance of plankton — animal or plant — in the two sides of the Pacific, or between different zones of latitude in either side, we need not speculate on that point here.

The cause of the greater poverty, as to oxygen, of the mid-strata of the western side of the North Pacific than of the North Atlantic calls, however, for a further word, for this is one of the greatest ecologic differences between the two oceans.

At bottom, as Schmidt (1925) has remarked, this indicates greater staleness of the water, i.e., a longer isolation in the deeps, for we have no warrant for assuming greater consumption of oxygen per unit area in the Pacific than in the Atlantic, whether widespread, or in the particular localities where the amounts of oxygen have been measured.

This greater staleness certainly results from differences in subsurface circulation, the most reasonable explanation being that it reflects a difference in the relative importance, as aerating centres, of the mass sinkings in the subarctic and in the subantarctic zones, whence the ocean deeps are replenished.

In this connection we have to consider chiefly the mid-water currents, comparatively low in salinity (34–34.4 ‰), that meridional profiles of the Pacific (Wüst, 1929), as well as of the Atlantic, show

as sinking from the surface in latitudes 50°–60° north and south, to spread thence equatorward, at depths of 800–1500 meters.

It seems established by recent studies of oxygen distribution and of subsurface circulation, as Wattenburg (1929) maintains, that the midstratum of the North Atlantic receives its oxygen chiefly from sinkings in the subarctic, via meridional expansion of the deep horizontal currents, that is, from a source comparatively near at hand.

The oxygen poverty of the mid-depths off California points to a much longer journey after the water in question sinks from the surface. This, with the probability that subarctic sinkings in the North Pacific are relatively small in volume and confined to the western side, suggests that the subantarctic, not the subarctic, is the chief source of aeration for the deep strata throughout the South Pacific, and for the eastern side of the North Pacific as well, at least to latitude 40° N.

Wüst (1929) on the other hand concludes that the mid-drift of northern origin spreads equatorward as far as the tropical belt in the North Pacific. But his reconstruction is based on meridional profiles of temperature and salinity for the centre and western margin of the Pacific alone. Hence the discrepancy may be only apparent, for in the northern hemisphere water of northern origin, drifting equatorward (as deflected by the earth's rotation) must be concentrated in the western side, while water from the south would tend to cross, obliquely, to the eastern.

VI. Phytoplankton

It is obvious that a collection of phytoplankton confined to a period of one month gives no basis for reconstructing the seasonal cycle for other times of year. The absolute abundance of diatoms and peridinians in Monterey Bay, at the time of our work there, is, however, of interest as bearing on the conditions of organic production in other parts of the sea where upwelling circulation governs, while the list of species, by Dr. Mann (p. 532) helps to establish the general composition of the summer diatom flora of the region.

Gran (1929), from anaylsis of the voluminous literature on conditions prevailing around the northern coasts of the Atlantic, has recently emphasized the importance of the rôle played by nutrients washed down from the land in maintaining the fertility of coastal waters in temperate latitudes. He also proposes a classification of the "three principal types for the yearly development of the plankton" (1929, p. 60), based on the interrelationship between the abundance

and periodicity of the supply of foodstuffs from this source, and the seasonal and regional variations in the activity of vertical circulation.

The coasts of middle and southern California offer, by contrast, the best available opportunity to study the association between plant production and mass upwelling. And the activity of upwelling in the immediate offing of Monterey makes this an especially interesting locality from this viewpoint.

During our work in July, 1928, phytoplankton was collected at the surface at most of the stations, with ordinary tow nets of No. 20 bolting silk. Seventy quantitative measurements of the plankton were also made by the simple but sufficiently accurate method (now standard at the Scripps Institution of Oceanography, Allen, 1929) of filtering measured volumes of water (usually 5 or 8 liters) through fine bolting silk with mesh openings averaging about .05 mm. These quantitatives include surface samples at twenty stations, with subsurface samples at eleven, mostly at intervals of 10 meters, downward to 40–50 meters (table p. 525). The counting of diatoms and of peridinians was done by Prof. W. E. Allen, of the Scripps Institution, who has also contributed much of the substance of the following discussion.

Technically this filtration method is satisfactory for cells as large as most of the planktonic diatoms and the thecate peridinians. And if samples enough could be taken simultaneously throughout the general area, the resultant picture would correctly represent the regional variations existing at the time, for these groups. But when counts are made several miles apart, it is obvious that if diatoms are streaky in occurrence, as is often the case, station to station differences in counts of the numbers of cells in given volumes of water might give an erroneous idea of the general state. And if the samples are taken over as long an interval as were ours, a rapid multiplication, or a high death rate, may further obscure the regional picture.

It was in the hope of guarding, in some degree, against the error (of unknown magnitude) that might result from streaky occurrence of the micro-plankton, that the tows were made. Unfortunately, however, inability to maintain an even rate of speed while towing, and heavy surging caused by the rough sea, made the net catches even less reliable as indices to quantitative distribution than is usually the case.

We hesitate, therefore, to draw any definite inferences from the fact that while the volumes of these catches roughly parallel the numbers of cells per liter over the bay as a whole for the stations occupied during the period July 17–July 23 (Stations 16 to 28), there is no correspondence at the stations occupied July 5–16. As the technical pro-

cedure was the same during the two periods, the implication is that diatoms were more evenly distributed through the water during the later period.

In most of the catches, whether quantitative, or by tow net, diatoms greatly outnumbered peridinians. At only one station (26) were peridinians more numerous than diatoms, though at one other (25) peridinians (about one-third as numerous as diatoms) were the larger in volume. Both of these stations were situated in the northern side of the bay, near the Santa Cruz shore. And since collections were made elsewhere in the bay on that same day and a day or two before, a regional rather than a seasonal segregation appears, with peridinians dominating in the Santa Cruz side, diatoms throughout the remainder of the bay.

A. Diatoms

The numbers of diatoms and their condition, whether good or bad (moribund or dead), are given in the table on page 525, contributed by Prof. Allen.

1. *Numerical abundance*

It is, of course, impossible (on the basis of one month's work) to state whether conditions as existing in July, 1928, were typical for that season of the year; it may have been a rich summer for diatoms, or a poor. But certainly in that particular month the planktonic diatom flora of Monterey Bay ranked among the richer concentrations of diatoms that have yet been described for the open ocean, and even approached the tremendous production that occurs in some enclosed waters. Thus the maximum number of diatom cells per liter, from our counts (nearly two million) compares with eight million Skeletonema cells recorded in the Baltic in June, 1906; with two million diatom cells per liter in Kiel Bay in April of that year (Lohmann, 1908); with a net catch reported there by Brandt (1902, p. 71) that indicated about six million per liter; and with a maximum of eight hundred thousand cells per liter at Storeggen, on the Norwegian coast (Gran, 1929).

And while still larger numbers have been recorded in enclosed coastal waters at the time of mass production — witness Marshall and Orr's (1927) record of 2,500,000 chains of Skeletonema per liter in the Clyde sea area, in April, which, by Gran's (1929) reckoning, indicates some twenty million cells per liter — the average at Monterey

Numbers of Diatoms Cells per Liter, at Different Stations and Levels, Counted by W. E. Allen

Sta.	Levels											
	Surface		10 meters		20 meters		30 meters		40 meters		50 meters	
	Condition		Condition		Condition		Condition		Condition		Condition	
	Good	Bad	Good	Bad	Good	Bad	Good	Bad	Good	Bad	Good	Bad
1	212200	180250										
2	29700	65150										
3	4600	2100										
4	150570	36500									87200	53400
5	330600	63400									22400	4160
7	970000	109300	547520	28400	193160	23160	12480		7680	8960	5760	2400
8	1321100	241400										
9	676750	150400										
10	360450	33800	70080	11040	170680	31640	5120	9760	8640	960	3200	1920
12	1736600	163500	49920	6560	13920	3680	5920	9280	8800	8480	16160	5120
13	1173050	54500	105120	37600	14400	12480	1600	320	2240	1280		
15	698160	161680	622080	136720	390040	139160	107520	66400	53760	39200	40000	38880
16	897000	109600	1020960	175120	261040	115680	41280	43520	3040	8160	1120	3040
18	1262600	228200			532080	260400	97080	64600	16480	14560	4480	5760
19	538880	221120	1242000	487200	442480	96960	220960	91360				
21	401840	67840										
22	95360	40720										
23	367200	103680										
24	299680	171840	1702080	351680	173040	97360	5120	11840	10560	8320	5120	35040
25	110640	61120										
26	6240	4320										
27	27680	10880										
28	2720	6080										
Av. good and bad	1,201,000		837,000		330,000		88,000		25,000		24,000	

Bay would be ranked as unusually high for any station in the open North Atlantic. Furthermore, the presence of a relatively large percentage of dead cells in our catches suggests that diatoms had been even more abundant in Monterey waters earlier in the season.

Comparison between the few Monterey counts and the extensive series that have been published for southern California waters is made more dependable than has usually been the case for different localities by the fact that the methods used were not only the same, but the counts made by the same individual. The average number at the richest level of Monterey Bay (about one million per liter) parallels roughly the richest weekly average recorded at La Jolla Pier for the years 1921–1924 (Allen, 1927, 1928a; Dorman, 1927a; Sleggs, 1927). And the maximum for Monterey Bay (two million) was more than four times the maximum recorded for the offing of La Jolla in the summers of 1924 or 1926 (Allen 1928, 1928b).

Thus present indications are that Monterey Bay is on the whole the more productive of the two localities in planktonic diatoms, unless 1928 was an unusually productive year. But much more extensive observations would be needed to definitely establish such a difference, because occasional waves of production, resulting for a time in large counts, are to be expected wherever these unicellular plants exist in any abundance. At the Pier at Point Hueneme, California, for example, Allen (1928a) reports one weekly average of two million per liter in 1924, although the averages for the richest weeks of the year there have usually approximated the July, 1928, average for Monterey.

Such counts of diatoms as have been made in the open Pacific off Oregon, to the north, have also been of about the same order of magnitude. Lewis (1927), for example, reports a maximum of about half a million per liter for the summer and autumn of 1924.

Unfortunately no comparison can yet be made between the abundance of diatoms in Monterey Bay, and in the coastal waters of British Columbia, because the estimates by Mounce (1922) and by Hutchinson (1928) of the amounts present in the Straits of Georgia were volumetric, not numerical, and the catches made by methods with which our towings are not comparable.

More specific examination of the Monterey catches is interesting from the standpoints of seasonal progression, as well as of regional and vertical distribution.

Successive counts at a pair of stations near Point Pinos, and at two pairs at the mouth of the bay, showed a decrease in the number of diatoms during the last half of the month, as follows:

Off Point Pinos:

Date	Sta.	Diatoms at surface, total per liter
June 30	1	392,450
July 5	5	394,000
July 23	28	8,800

Mouth of Bay, A:

Date	Sta.	Diatoms at surface, total per liter
July 10	7	1,079,300
July 21	21	469,680

Mouth of Bay, B:

Date	Sta.	Diatoms at surface, total per liter
July 13	10	394,250
July 21	22	136,080

This decrease cannot be laid to depletion of phosphates or silicates, for while at one offshore locality (Loc. A above) a slight decrease in the amounts of these solutes was registered for the surface water (table, p. 567), the reverse was the case at the other locality. And while no data as to phosphates or silicates are available for the earlier of the two stations off Point Pinos, both silicates and phosphates were present there in relatively large amounts at the latest station (28). At the offshore localities, the decrease in diatoms may have resulted from exhaustion of nitrates, for in each case (Loc. A and B), the surface water was nitrate-free at the later station, whereas at Loc. B, there had been 0.039 mg. per liter in the surface water at the earlier station. But at the Point Pinos locality, where the smallest diatom count was from water relatively rich in nitrates (Sta. 28, 0.119 mg. per liter), this explanation does not apply unless sudden regeneration of nitrates can be supposed to have taken place there, after diatoms had diminished.

It is the common experience to find the great majority of diatom cells in good condition while multiplication is proceeding actively, with the proportion of moribund and dead cells (shown by poor condition) increasing after the wave of production has passed. Prof. Allen, for example, contributes the information that off southern California, where diatoms are, as a rule, scarce in August, the catches made during that and the preceding month have been in poor condition.

Thus the relatively large percentage of the diatom cells that were either dead, or at least in bad condition, at most of the stations, with the fact that the ratio of cells in good to those in bad condition, was about the same at 50 meters as at the surface (table, p. 525), equally suggests that the last half of July, 1928, was in general a period of waning production. But the presence of many more diatoms at a station close to the Hopkins Marine Station on July 17 (15) than had been found there two weeks earlier (4) shows that active production was still taking place locally, as late as the middle of the month, though the upper 10 meters of water at the locality in question was then so poor in phosphates (14, 0.018–0.02 mg. per liter) as to make it likely that fewer diatoms would have been found there a week later.

In short, the available data suggest that fewer diatoms would have been found in Monterey Bay in August, 1928, than were actually found there in July, and that still larger numbers would have been found in June.

A seasonal succession of this order was, indeed, to be expected, for students in various parts of the world have found diatoms scarce in midsummer, in mid-latitudes, following periods of great abundance, except in estuarine situations, or in localities kept thoroughly churned by the tide, where active production may continue right through from spring to autumn.

Attempts to trace the ups and downs of the local production of diatoms off central and southern California are complicated by the possibility that the sudden appearance of a swarm may result from their transport thither, by longshore currents. This would result in an irregular succession of maxima and minima, of much the sort that has actually been recorded off La Jolla. But in spite of this disturbing factor Monterey Bay offers an exceptionally favorable opportunity to examine whether inherent reproductive periodicity of the diatoms themselves has any part in causing the summer minimum, for it seems certain that in this region, so richly stocked with nutrients at deeper levels, upwelling must soon refertilize the surface layers if the latter be temporarily denuded by an overproduction of vegetation.

In this connection, Prof. Allen points out, differences between different species in the ratio of living to dead cells are suggestive. Thus *Asteromphalus heptactis*,[1] which occurred with considerable frequency, in the quantitative samples at all levels down to 50 meters, was usually represented by dead cells only, except at Stations 10–13, where it appeared in good condition in the upper levels *Ditylium brightwellii*[1]

[1] Identification by Prof. W. E. Allen.

(surface only) was also represented chiefly, if not entirely, by cells in bad condition. On the other hand *Asterionella japonica*,[1] and *Nitzschia seriata*[1] not only occurred frequently at all levels, in some numbers, but were for the most part in good condition. Differences of this sort corroborate the evidence of various sorts, brought out in other seas, both by observation and by cultural experiments, that different species differ so widely in their cultural requirements that some thrive in water that is barren for others.

2. *Regional distribution*

The most striking regional variation in the quantitative distribution of diatoms at the time of our studies was their scarcity in the northern side of the bay (Stations 25, 26). But diatoms change so rapidly in abundance that this may have been only a temporary phenomenon, presaging a progressive decrease from north to south across the bay. And, for this same reason, there is no warrant for crediting the distribution of richer and poorer catches (Fig. 43) with geographic significance, for it may have been briefly transitory. The parallelism between regional distribution of diatoms, and that of oxygen and of phosphates, has already been commented upon (pp. 515, 512).

Counts of samples taken close to the tide line, off the beach at the Hopkins Station, suggest that the water averages much less productive in diatoms immediately next the coast than it does a mile or more out in the bay, for the largest weekly average for 1923 was only about 6,000 cells per liter there (Dorman, 1927a), while in 1924 only three weekly averages exceeded 11,000 (Allen, 1928b). Therefore samples taken in a situation of that sort cannot be accepted as representative, in this particular region.

3. *Vertical distribution*

The diatom flora of Monterey Bay seems not only to average richer than that off La Jolla in summer, but in July, 1928, its vertical distribution was widely different, when quantitatively expressed.

At the more southerly locality, in the summer of 1926 (apparently a representative year), more than 75% of the total number of diatoms were concentrated in the stratum between the 25 meter and 40 meter levels (Allen, 1928; Moberg, 1928). This is in line with data obtained at La Jolla in earlier years (Allen, 1923; Dorman, 1927; Sleggs, 1927), which had already given strong indication that the normal production

[1] Identification by Prof. W. E. Allen.

off this part of the coast in summer is greatest 20–40 meters below the surface.

In Monterey Bay, on the contrary, our largest catch was made at the surface (table, p. 525), and the average number per liter was also greatest at the surface, slightly less at 10 meters, and decreasing with depth, as follows:

Depth meters	Surf.	10	20	30	40	50
Average Diatoms per liter	1,021,109	836,761	330,151	88,240	25,140	23,986

Two thirds of the diatoms of Monterey Bay were thus concentrated in the upper 15 meters of water at the time (fig. 41). Furthermore, Prof. Allen reports that the number of species represented in the quantitative samples was about twice as great at the surface (29) as at any level deeper than 20 meters, but only slightly greater than at 10 meters. All this unites to show that in July, 1928, the chief production in Monterey Bay took place between the 10 meter level and the surface. And maximum production seems to have been nearer to the surface than to 10 meters, because the surface catches were much greater than the 10 meter catches (living and dead cells combined) at four out of eight stations, the 10 meter catches considerably the larger at only two, with little difference between the two levels at the remaining two stations.

The difference between Monterey Bay and the offing of La Jolla, with respect to the vertical distribution of diatoms, so closely parallels the difference in the vertical distribution of phosphates and of nitrates (pp. 499, 500), that a causal connection may reasonably be assumed. The fact that the surface waters at La Jolla are kept practically denuded of nitrates, and decidedly poor in phosphates, is sufficient explanation for the barrenness of the superficial stratum there. Under such circumstances, and with upwelling so slow that the rich water from the deeps is denuded before reaching the surface, production is greatest at the greatest depth to which sunlight penetrates with intensity enough for active photosynthesis. In Monterey Bay, however, under the conditions existing at the time of our survey, upwelling is so much more active that the surface waters are kept more adequately stocked, or if locally depleted, seem to be replenished sooner, so that the supply of nutrients allows active multiplication of diatoms closer to the surface,

where the intensity of light is most favorable. The fact that catches taken as close to the surface as was feasible averaged the largest, and that the percentage of dead cells was no greater there than at 10–20 meters, is good evidence that sunlight was not intensive enough to be generally lethal more than a few centimeters down at the time, if it ever is at this latitude. On the other hand, the decrease in the number of diatoms from the surface downward, in the face of increasing richness of nutrients, may be assumed chiefly to reflect the corresponding decrease in intensity of penetrant sunlight. And since the same species were prominent at different levels, it seems that those dominant at the time all required approximately the same intensity of light, for active photosynthesis. Upwelling currents may also have some effect in bringing diatoms up toward the surface.

The facts that the average number of diatoms at 40 meters was larger in Monterey Bay [1] in July, 1928 than off La Jolla during the summer of 1926; that at Monterey there were nearly as many diatoms at 50 meters as at 40 (table, p. 525); and that the percentage of dead cells was no greater at deep than at shallow levels; indicate that photosynthesis was proceeding at least down to 50 meters at the time. And as Allen (1928) records a rapid falling off in the number of diatoms below 40 meters, for La Jolla, it seems that the photosynthetic zone is about as thick at the more northern of the two localities, in spite of the difference in latitude and greater prevalence of fog.

The diatom fertility-cycle in a region of upwelling, such as Monterey Bay in summer, may then be reconstructed as follows. The clouds of diatoms existing in the upper stratum of water consume the nutrient salts in large amounts. With increasing depth decreasing light limits the activity of their photosynthesis and the rapidity of their multiplication, correspondingly limiting the drafts that they make on the fertility of the water. So long as upwelling supplies rich water to the surface stratum with sufficient rapidity, the combination of abundant nutrition with intense light makes this the zone of chief production, as was the case in July, 1928. But if the rate of upwelling were to decrease so much that the diatoms depleted the surface layer, the zone of maximum production would necessarily sink (as at La Jolla), as the diatoms previously living near the surface died off. There might even be some actual increase in production, temporarily, in the deeper strata, as the thinning out of those above allowed more sunlight to penetrate. But unless a new pulse of upwelling soon followed, the whole photic zone would either become depleted of food stuffs, and diatoms fall to a

[1] Monterey, about 25,000 per liter; La Jolla 7,000 to 15,000 at two stations (Allen, 1928, p. 206).

minimum, or a balance might be reached, allowing a moderate production to proceed near the lower boundary of the photic zone, as happens off La Jolla. Whether this latter state ever develops in Monterey Bay is an interesting question for the future.

It is much to be regretted that no data as to the concentrations of silicates, phosphates, or nitrates, were obtained at the stations in the northern side of the bay (25, 26), where, alone, peridinians were dominant.

The fact that the numbers of diatom cells in bad condition showed, on the average, about the same rate of decrease, from the surface downward as did those in good, runs counter to the expectation that where the chief production takes place near the surface, dead cells, as they sink, will be most prominent, relatively, in the deeper strata. And Prof. Allen contributes the like information that dead cells have not dominated the samples from 50 meters, or deeper, off southern California. This suggests that dead diatoms sink so slowly in the low temperatures (consequently high viscosities) and upwelling circulation prevailing off California that most of their shells disintegrate before reaching a depth of 50 meters, and so help to maintain the cycle of silica *in situ*. At any rate, writes Prof. Allen, "the small showing of dead specimens beneath a large representation of decadent specimens at several points in Monterey Bay is a phenomenon which needs explanation."

4. *Dominant species of diatoms*

Dr. Mann's examination of samples from the tow nettings (p. 430) shows a diatom flora decidedly varied, qualitatively, for he detected 107 species.

List of Diatoms, Identified by Dr. Albert Mann, from Random Samples from Eighteen of the Tow-net Hauls

Column A gives the percentage of the stations at which the species was found; column B gives the percentage of the stations at which the species was noted by Dr. Mann as "common"; column C, the percentage of the stations at which it was noted as "very common."

	A	B	C
Actinocyclus curvulatus Janisch	5	0	0
Ehrenbergii Ralfs	11	0	0
Ralfsii W. Smith	5	0	0
Actinoptychus alternans Mann	83	22	0
areolatus Mann	11	5	0
undulatus Bail.	44	5	0

	A	B	C
Amphora oblonga Greg.	5	0	0
Asterionella japonica Cleve	72	5	0
Asteromphalus heptactis Bréb.	100	61	22
Aulacodiscus	5	0	0
Biddulphia aurita Bréb.	39	0	0
extensa Mann	94	0	0
mobilensis Bail.	5	0	0
peruviana Gran	5	0	0
antideluviana Ehr.	5	0	0
Cerataulina Bergonii Perag.	22	0	0
Chaetoceras atlanticum Cleve	50	0	0
boreale Bail.	22	0	0
constrictum Gran	90	22	22
contortum Schutt	80	28	17
coronatum Grun.	11	0	0
crinitum Schutt	90	39	33
criophilum Castr.	50	0	5
debile Cleve	94	28	22
decipiens Cleve	100	44	50
densum Cleve	22	0	0
diadema Gran	44	0	0
difficile Cleve	22	0	5
didymum Ehr.	94	50	22
gracile Schutt	5	0	0
incurvum Bail.	17	0	0
ingolfianum Ost.	5	0	0
laciniosum Schutt	5	0	0
mitra Cleve	11	0	0
pelagicum Cleve	5	0	0
peruvianum Bright.	5	0	0
pseudocrinitum Ost.	11	0	0
scolopendra Cleve	100	50	11
Schuttei Cleve	33	0	0
teres Cleve	44	0	0
Weissflogii Schutt?	5	0	0
Willei Gran	22	0	0
Cocconeis costata Greg.	5	0	0
curvirotunda T. & Br.	5	0	0
disrupta Greg., var.	5	0	0
panniformis Br.	5	0	0
scutellum Ehr.	17	0	0

	A	B	C
Coscinodiscus asteromphalus Ehr.	11	0	0
concinnus W. Smith	50	5	0
curvulatus Gran	11	0	0
denarius A. Schmidt	5	0	0
excentricus Ehr.	44	0	0
Kutzingii A. Schmidt	5	0	0
lineatus Ehr.	37	0	0
Normanii Greg.	5	0	0
oculus-iridis Ehr.	11	0	0
pacificus Ratt.	11	0	0
praetextus Janisch	5	0	0
radiatus Ehr.	17	5	5
rex Wall.	5	0	0
subtilis Ehr.	61	0	0
symbolophorus Gran	5	0	0
Woodwardii Eul.	33	0	0
Coscinosira polychorda Gran	28	0	0
Corethron valdiviae Karst.	33	0	0
Cyclotella striata Kutz.	44	0	0
Ditylium Brightwellii West	83	0	0
Entopyla incurva Arn.	5	0	0
Eucampia groenlandica Cleve	33	0	0
zoodiacus Ehr.	100	39	11
Grammatophora marina Lyng.	5	0	0
Hyalodiscus subtilis Bail.	5	0	0
Isthmia nervosa Kutz.	5	0	0
Lauderia annulata Cleve	17	0	0
borealis Gran	33	0	0
delicatula Perag.	5	0	0
glacialis Gran	5	0	0
Leptocylindrus danicus Cleve	72	5	5
Licmophora californica Gran	5	0	0
Lyngbyei Kutz.	5	0	0
Lithodesmium undulatum Ehr.	50	0	0
Navicula directa W. Smith	11	0	0
formosa Greg.	5	0	0
Nitzschia gazellae Karst.	28	0	0
longissima var. closterioides Grun.	55	0	0
seriata Cleve	90	11	11
Pleurosigma acus Mann	5	0	0
delicatulum W. Smith	5	0	0

	A	B	C
Rhizosolenia alata var. obtusa Hens.	22	0	0
semispina Hens.	39	0	0
setigera Bright	28	11	0
Stolforthii Perag.	39	0	0
Sekletonema costatum Grev.	61	0	0
Stephanopyxis corona Ehr.	5	0	0
turris Grev.	11	0	0
Synedra nitzschioides Gran	83	11	0
Thalassiosira baltica Gran	5	0	0
decipiens Jorg.	50	0	0
gravida Cleve	78	5	0
hyalina Gran	5	0	0
Nordenskiöldii Cleve	5	0	5
subtilis Ost.	5	0	0
Thalassiothrix Frauenfeldii Gran	22	0	0
longissima Cleve	17	0	0
Trigonium arcticum Cleve	22	0	0
montereyi Bright.	5	0	0
Tropidoneis antarctica Gran	28	0	0
membranacea Cleve	22	0	0

In spite of the long list of species comparatively few were prominent in the collections, as is usually the case in short series of open-sea towings. Prof. Allen, from examination of the quantitative samples, records various species of Chaetoceras as forming the bulk of the catches. And Dr. Mann's lists equally emphasize the dominance of the phytoplankton by this genus, except in the northern side of the bay, where peridinians, not diatoms, predominated (p. 524).

A glance at column C in the preceding table will make this clear, for out of fourteen species appearing there nine belong to the genus Chaetoceras.

Among the twenty-six species of Chaetoceras detected by Dr. Mann, the following seven greatly predominated over the others, both in regularity of occurrence, and in abundance relative to other diatoms:—*C. constrictum*, *C. contortum*, *C. crinitum*, *C. debile*, *C. decipiens*, *C. didymum* and *C. scolopendra*. *C. decipiens* was on the whole the most important of these, at the time, for it occurred at all the eighteen stations from which samples were examined, and was recorded by Dr. Mann as "common" or "very common" at every station but one.

By the ranking in the table (p. 533), *C. didymum* and *C. crinitum* seem on the whole to have been numerically the predominant species at the

time (after *decipiens*), and while *scolopendra* and *debile* both occurred somewhat more regularly in the lists, it is probable that sufficient search would have shown all the species of the group to have been universally distributed over the bay, at the time. All of these dominant species belong to the subgenus Hyalochaete, and all of them, except *decipiens*, are small forms.

No regional separation in the relative importance of these species of Chaetoceras appears for the inner parts of the bay. But the catch at our outermost station (17) is set apart by the fact that the species dominant there (*C. eriophilum*, noted by Dr. Mann as "vc") is not only distinctly oceanic, but was of very minor importance inshore, for it was detected in only 50% of the other hauls, and invariably noted there as "few" or as "scarce."

All the other species of Chaetoceras were represented sparsely, in every case recorded as "few" or "scarce." Their relative regularity of occurrence was as follows:

50% of the hauls, *atlanticum*
44% of the hauls, *diadema, teres*
33% of the hauls, *Schuttei*
22% of the hauls, *boreale, densum, difficile, Willei*
17% of the hauls, *incurvum, pseudocrinitum*
11% of the hauls, *coronatum, mitra*
5% of the hauls, *gracile, ingolfianum, laciniosum, pelagicum, peruvianum, weissflogii*

Of diatoms other than Chaetoceras, *Asteromphalus heptactis* and *Eucampia zoodiacus* were universal (100% of the stations), *Biddulphia extensa* probably also (94%); while *Asterionella japonica, Leptocylindrus danicus, Thalassiosira gravida, Ditylium brightwellii, Actinoptychus alternans, Synedra nitschioides* and *Nitzschia seriata* were also detected at the great majority of stations (72–90%). For each of them the localities of record include stations close in shore, as well as in the mouth of the bay, proving that their distribution was general there at the time.

Among this group of regularly occurring species, *Asteromphalus heptactis* and *Eucampia zoodiacus* alone rivaled the dominant members of Chaetoceras in floral importance, the former being recorded as "common" or "very common" in all but one of the catches, the latter in nine out of the eighteen stations. *Actinoptychus alternans, Asterionella japonica, Coscinodiscus concinnus, C. radiatus, Leptocylindrus danicus, Nitzschia seriata, Rhizolenia setigera,* and *Thalassiosira gravida* were occasionally common; but within this group of species, numerical

abundance did not in all cases correspond to regularity of occurrence. Thus while Leptocylindrus was recorded at thirteen stations, it was common only at two, Thalassiosira common at only one out of fourteen, Synedra at three out of fifteen, whereas *Rhizosolenia setigera* was common at two of the four stations where alone it was detected, *Actinoptychus arcolatus* at one of two, *Coscinodiscus radiatus* at two out of its three stations of record.

The fact that the remaining eighty-five species, including several that occurred with considerable regularity [1] were invariably either "few" or "scarce" illustrates the qualitative monotony that may characterize the pelagic diatom-flora, even when actually composed of many species.

In fact no less than thirty-six of the species were found at only one station each, ten of them at only two stations; in most cases represented by scattered individuals only.

This group of rare species is, however, more interesting from the distributional standpoint than its numerical strength and the sporadic occurrence of its members might suggest, for it includes a considerable list of bottom forms. To find a scattering of this floral category in plankton gatherings taken near land is usual, as they are either swept up from the bottom by turbulent movements of the water, or carried out from the shore line with other flotsam. The surface water had received an unusually large contribution from this source off Point Pinos, at the close of the series (Station 28), the list for that haul including eleven species of this group, that were not detected in any of the other samples, as follows: — *Actinocyclus curvulatus*, Aulacodiscus, *Biddulphia antideluviana*, *Cocconeis costata*, *C. panniformis*, *Entopyla incurva*, *Grammatophora marina*, *Hyalodiscus subtilis*, *Isthmia nervosa*, *Licmophora Lynbyei* and *Trigonium montercyi*.

Apart from these bottom forms at Station 28, and except for the dominant species at the outermost station, analyses of the catches show no definite regional localization of different species, for such of them as occurred frequently enough for their recorded distribution to be significant were found both inshore, and out in the centre of the bay. Neither is any seasonal succession of species apparent.

It is for this reason that we have not included in the table the lists of species for individual stations.

Catches made close to the beach at the Hopkins Marine Station,[2] interesting for comparison with the waters of the bay farther out in

[1] *Biddulphia extensa*, *Ditylium Brightwellii*, *Coscinodiscus subtilis*, *Skeletonema costatum*.

[2] Data contributed by Prof. W. E. Allen.

July, 1928, showed dominance by the following species, at some time during June, July or August, 1923, 1924 and 1925.

In 1923, *Asterionella japonica*, *Chaetoceras compressum*, Chaetoceras sp.? Navicula sp.? and *Nitzschia seriata*.

In 1924, *Chaetoceras debile* and *Fragilaria islandica*.

In 1925, *Asterionella japonica*, *Chaetoceras longianum*, *Eucampia zoodiacus*, and *Leptocylindrus danicus*.

All these species, except the Navicula and Fragilaria, were recognized in the towings of July, 1928, or may have been represented then among the unidentified species of Chaetoceras.

It is interesting that *Fragilaria islandica* appears among this list of dominant species, at this locality in summer, for it is a diatom usually considered an arctic and subarctic indicator. But as it was prominent during only one week of the entire series (25th week of 1924) this was evidently an unusual event.

Unfortunately the samples for these years were so scattered in date that they do not show the seasonal succession for any one year, while to combine the records for the three years might confuse annual with seasonal variations.

The following tabulation of the ten species reported by Prof. Allen as most prominent during those months of spring when samples were obtained in two of the three years shows that annual differences are great.

	1923	1924	1925
March	*Skeletonema costatum*	*Asterionella japonica* *Chaetoceras scolopendra* Chaetoceras sp.? *Detonula schröderi* *Eucampia zoodiacus* Rhizosolenia sp.? Thalassiosira sp.?	*Chaetoceras curvisetum* *Skeletonema costatum*
April	no data	Chaetoceras sp.? Nitzschia sp.? *Skeletonema costatum*	*Chaetoceras sociale*
May	no data	*Chaetoceras difficile*	*Chaetoceras sociale* *Chaetoceras debile* *Chaetoceras compressa* Chaetoceras sp.?

In general these data for 1923–1925 suggest that Monterey Bay does not show the regular seasonal succession of different species and genera of diatoms that so generally characterizes coastal waters in regions where there is a wide seasonal variation in the physical, chemical

and circulatory state of the water (the Gulf of Maine for instance, Bigelow, 1926), but that species that dominate at one season in one year, may do so at another season in another. And most of the species that often dominate, at any season of the year, are present in moderate numbers in midsummer. A similar seasonal irregularity, from year to year, in the succession of diatom species, evidently obtains off La Jolla, as shown by Allen's (1928) tables, but with a pronounced preponderance by the genus Chaetoceras. Allen's remark (1928, p. 365), that "there is no apparent indication that the abundance of any species gives ground for predicting that it will be followed or replaced by any certain other species" off southern California, applies equally to Monterey Bay, so far as can be judged from data yet available.

B. Peridinians

The three quantitative samples in which the number of dinoflagellates equaled 10,000 per liter (23, 25, 26), including the only one where they outnumbered the diatoms, were all taken in the northern side of the bay, and on one day, July 21. Stations 25 and 26, were also the only localities where the catches of the tow net can be characterized as "peridinian plankton." But tows on that same day, and two days later, also yielded a greater bulk (though a smaller number) of peridinians than of diatoms, at the mouth of the bay (22), and near Point Pinos (28) where diatoms had greatly predominated earlier in the series (10, 15). Thus a general replacement of diatoms by peridinians is indicated with the advance of the season, progressing from north to south across the bay, from a center of peridinian production near the Santa Cruz shore.

The fact that most of the peridinians at all of the stations were in good condition, as tabulated below, is further evidence that they were multiplying actively during the last part of July.

Peridinians, like diatoms (p. 530), averaged most abundant at the surface or close below it.

Although the numbers of peridinians per liter were insignificant, contrasted with the rich catches of diatoms, the average of about 7,000 per liter for the surface samples, for Monterey Bay as a whole, at the time, is approximately four times as great as the highest daily average for La Jolla, for the period 1920–1924, and more than seven times the July average there (Allen, 1928, p. 388). At Point Hueneme, near Santa Barbara, intermediate in location between La Jolla and Monterey Bay, the July average rose considerably above the Monterey average in three of these five years, but fell slightly below it in two, while the means for that month and for August for the five years at Point Hueneme (7,500–6,900) were close to the Monterey figure.

COUNTS OF DINOFLAGELLATES PER LITER AT DIFFERENT STATIONS AND LEVELS, BY W. E. ALLEN

Sta.	Levels											
	Surface		10 meters		20 meters		30 meters		40 meters		50 meters	
	Condition		Condition		Condition		Condition		Condition		Condition	
	Good	Bad	Good	Bad	Good	Bad	Good	Bad	Good	Bad	Good	Bad
1	200											
2	1700	100										
3	2000	200										
4	1200	200									320	160
5	300											
7	800		480		320	160			160		320	
8	2200											
9	8300	200										
10	1700		160		320				160			
12	1800		320				1600			160	160	
13	500		320		640		480					
15	8960		6400		1720		640		640		480	
16	7800		1920	160	640						160	
18	3600	200			1820		160		320		320	160
19	8640		3200		6080		3360					
21	4000											
22	3680	160										
23	12800	320										
24	4320	800	5120		640	320	160		480			
25	62080											
26	23040	160										
27	640	480										
28	1120	160										

Av. good and bad at surface, 7146

These comparative counts indicate that the production of peridinians in midsummer is of about the same order of magnitude in Monterey Bay as in the vicinity of Santa Barbara; and correspondingly greater than at La Jolla, farther south.

Such data as are available suggest that the coast waters are also distinctly more productive of peridinians off middle California than along the sector next to the north, for the largest number per liter found by the U. S. S. "Guide" off Oregon in the summer and autumn of 1924 was only 160 (Lewis, 1927), while the maximum in samples taken by the U. S. S. "Pioneer" during that spring between the offings of San Diego and of Seattle was only 1,958.

Prof. Allen reports the presence of the following four species in about half the quantitative samples; *Ceratium furca* Ehr., *Dinophysis acuta* Ehr., *Peridinium divergens* Ehr., and *P. ovatum* Pouch. Among these, *C. furca* was not only the most regularly recurrent, but locally the most abundant. Probably it was universally distributed over the bay at the time, for at least a sprinkling of it was detected at fifteen stations [1] out of the twenty-one where tows were made. And it was almost entirely responsible for the large gatherings of peridinians in the northern side of the bay on July 21, just mentioned (p. 539, Stations 23, 25, 26).

Prof. Allen reports *Dinophysis acuta* as next in numerical strength in the quantitative samples, and it also was detected in most of the tows. About half of the tows also showed a scattering of another Ceratium, without developed antapical horns, provisionally identified as a form of *C. tripos*, as well as various unidentified species of Peridinium and of Dinophysis.

It is interesting, Prof. Allen points out, that *Prorocentrum micans* Ehr., the dinoflagellate that has most frequently been prominent in southern Californian waters of late years, was noted in only five of the quantitative samples, always in small numbers.

The dominance of the peridinian community by *Ceratium furca* in Monterey Bay, but by Prorocentrum off La Jolla, is a difference for which no reasonable explanation can yet be offered, unless the difference in latitude.

VII. Zoöplankton

Only a preliminary survey of the animal plankton has yet been made, consequently we can mention only the more prominent species: [2] discussion of many others — and of some whole groups — must be postponed to some future occasion. Fortunately, however, it proved that most of the dominant members of the different groups are species so well known in northern seas that their identification offers no special difficulty. We are, therefore, able to present the general facies of the planktonic communities that were living in different places and depths in the bay at the time, which after all, was the chief object of the biological part of our survey.

This is a matter of considerable interest, from its bearing on the natural economy of this part of the sea, for (so far as we are aware),

[1] Stations 6, 9, 12, 15–19, 21, 23–28.

[2] The following collaborators have made preliminary identifications, in different groups: — C. V. MacCoy, Copepods; Alice Beale, Chaetognaths, Radiolarians; Mary Sears, Crustacea other than Copepods, Annelids, Tunicates, Siphonophores.

this is the first attempt to analyze the zoöplankton of any part of the open North Pacific from the standpoint of the association of groups and of dominant species.

To some extent the picture is confused (just as it is for the phytoplankton) by the fact that the series extended over a period of twenty-four days. Multiplication is, however, a slower process for most groups of planktonic animals than it is for the dominant groups of planktonic plants — diatoms and peridinians — and the general character of the community as a rule changes more slowly, unless mass migrations occur, carried by sudden indrafts of water of distant origin. Consequently the time factor is not so important in this case.

On the other hand the qualitative complexity of the community is greater for the zoö- than for the phytoplankton, making qualitative characterization more difficult.

The hauls were made with ordinary open nets of three sizes, 0.5 meter, 0.75 meter, and 1 meter in diameter, towed horizontally at various depths, from the surface down to 550–0 meters.

A. Quantity of Plankton

Only a cursory glance at the catches, as brought on board, was needed to show that no great concentrations of animal plankton were encountered, compared with the rich catches that are sometimes made with similar nets in the coastal waters of the boreal Atlantic, at the time of year when zoöplankton is at its maximum there.

No exact quantitative statement is possible, because no vertical hauls were made. Volumetric analysis of the horizontal tows is made more than usually unreliable (as it is for the phytoplankton) by irregularity in the speed of towing. However, it was only at stations where the ctenophore *Pleurobrachia pileus* was abundant — an animal so large that it needs but few individuals to yield large volumes of it — that the yield of the tows was at the rate of one liter or more, when reduced to a standard of thirty minutes towing with one meter net, except at one station (23) where the half-meter net, towed at 10 meters, passed through a population of copepods dense enough to yield at about double that rate, an amount that is frequently surpassed in the Gulf of Maine in the summer season (Bigelow, 1926).

The average volume, calculated as just stated, for all the tows, at 10 meters or deeper, was, roughly, 500 cc. But the facts that our tows were made during a period when diatoms were diminishing, and that they yielded considerable numbers of juvenile copepods and euphau-

siids (p. 547) makes it likely that much larger amounts of zoöplankton would have been found a few weeks later in the season. No comparative data, as to the volumetric abundance of the zoöplanktonic communities as a whole, are available for Pacific coast stations either to the north or to the south of Monterey, though some statistical studies have been made of the numerical occurrence of individual groups of animals off La Jolla (see bibliography), and in the straits of Georgia (Campbell, 1929).

The topography of Monterey Bay and its dominant upwelling circulation, with its geographic situation relative to the continental slope and Pacific basin, combine to make this an interesting region, in the present connection.

B. Bathymetric Stratification

Analysis of the more prominent members of representative groups, by depths of capture, shows that (irrespective of systematic relationships) they fall into two rather sharply defined groups: (a) those that occurred with some regularity in the tows at 50 meters and shoaler; (b) a bathypelagic community that were taken chiefly in our few deep tows from 300 meters or deeper, and only occasionally nearer the surface. No sharp line can be drawn between these two bathymetric groups, for here, as is always the case, the transition is bridged by species which, while most plentiful at considerable depths occur also right up to the surface. As examples we may cite the common oceanic euphausiid-shrimp *Euphausia pacifica* Hansen; also the splendid siphonophore *Nectodroma reticulata* Bigelow, which, by its abundance, characterized the deep tows at Stations 8 and 27, and fragments of which were also taken in shoal tows (pp. 546, 560). On the other hand, when a species, occurring only occasionally, is found in a deep tow only, the possibility must always be recognized that it may have been picked up near the surface while the net was being let out, or hauled in. This probably happened with the one specimen of the Narcomedusa *Solmundella bitentaculata* (p. 560).

In spite of such connecting species the two chief bathymetric communities were sufficiently distinct to call for separate discussion, as, in fact, is usually the case when towing is done down to depths greater than 300 meters. The one community, dwelling chiefly shoaler than 100 meters, the more directly reflects local conditions in its composition; the other, living deeper, is part of the faunal association that is characteristic of the 200–500 meter stratum of the ocean basins, generally.

Fowler's term "epiplankton" is convenient for the former if understood as covering the community of the superficial stratum in general, not of any particular depth-zone therein. In the case of Monterey Bay the inclusive term "bathyplankton" appropriately names the inhabitants of the mid-levels. None of our tows were deep enough to touch abyssal waters.

C. Epiplankton

The catches made in the tows between the surface and a depth of 50 meters are the most characteristic of Monterey Bay itself, because only a small percentage of the area of the latter is deeper than 100 meters (Fig. 1). And it is these shoal catches that are the most interesting, faunistically, because little was previously known as to the associations prevailing within the bay at any season (anywhere along this general coast-sector, for that matter), or as to their seasonal successions, though the presence of a great variety of planktonic animals had been observed within the bay at one time or another. In fact, Monterey Bay was nearly as virgin a sea, in this respect, as was the Gulf of Maine when the Museum of Comparative Zoölogy and U. S. Bureau of Fisheries commenced their joint exploration of its plankton in 1912 (Bigelow, 1926).

1. *General Associations*

So far as the presence of the more prominent species is concerned, the shoal catches proved decidedly uniform from station to station throughout the series, though regional differences in the relative importance of copepods, ctenophores, appendicularians and siphonophores resulted in notable differences in the general facies of the population from station to station. (See table, pages 546, 547.)

In several cases one or another group so predominated as to result in a decidedly monotonous assemblage. Thus surface hauls at Stations 1, 2, 5 and 6; 10 meter hauls at Stations 2, 12, 13 and 23; and the 50–0 meter haul at Station 6 yielded little except copepods. The ctenophore *Pleurobrachia pileus* formed the bulk of the catch from 10–0 meters at Stations 4 and 5, from 50–0 meters at Station 12. Oikopleura was predominant at the surface at two stations (4 and 18), as was the siphonophore *Muggiaea atlantica* on six occasions, in hauls from 10–0, 25–0, and 50–0 meters (table, p. 546). In the other hauls no one species outranked the rest to this extent, though one or two groups in combination were much the most prominent in most cases, as noted in the ac-

companying table (p. 546). Such dominance of the inshore plankton by one species, or by a few in combination, is a familiar phenomenon in the upper 50 meters, in coastal waters of moderately low temperature.

In analyzing the regional differences in dominance by the different groups, vertical stratification must be taken into account even within the superficial 50 meters, when subsurface hauls are made at different depths, because the relative importance of different groups is different at the surface, at 10 meters, and at 50 meters. Pleurobrachia, for example, was predominant only in hauls from 10–0 meters or deeper, whereas it was only at the surface that an abundance of Oikopleura marked any of the catches. Copepods, however, and *Muggiaea atlantica*, either separately, or in combination with some other group, dominated some of the deeper as well as some of the surface hauls. This stratification is best illustrated by stations where hauls were made at two or more levels. Thus at Station 4 *Oikopleura dioica* and another member of the genus not yet identified formed the most prominent element at the surface, Pleurobrachia at 10–0 meters. Similarly, at Station 5, copepods dominated at the surface, Pleurobrachia at 10–0 meters. At Station 12 Muggiaea and the copepod *Calanus finmarchicus* characterized the catch at 10–0 meters, Pleurobrachia at 50 meters while at Station 18 the surface catch was chiefly copepods and Muggiaea, the 10–0 meter catch chiefly the latter. And more instances of the same sort might be cited (table, p. 546).

Radiolarians as a group were also represented more abundantly and by a greater variety of genera in hauls from 25–0 and 50–0 meters than closer to the surface; so, too, the Hyperiid amphipod *Hyperia galba*, which occurred widespread over the bay. Among copepods, *Eucalanus elongatus*, and Tortanus were abundant only in tows from 50–0 meters. On the other hand Acartia, Microcalanus, and other minute species formed a larger percentage of the copepods at or near the surface.

Certain species, furthermore, such as *Euphausia pacifica*, appeared only in subsurface tows as adults, though larvae probably referable to them were plentiful at or near the surface. In the case of *Calanus finmarchicus* the surface may be described as a nursery at the time, for several of the surface tows yielded a large proportion of its juveniles, with older stages predominating at deeper levels, as is the general rule wherever the biology of this economically important copepod has been studied.

The feeding habits of different species also affect their associations, for when large rapacious animals multiply they may soon denude the water of its smaller inhabitants. Thus while copepods were important,

TABLE OF OCCURRENCE OF REPRESENTATIVE SPECIES IN HAULS FROM 50 METERS AND SHOALER

(Those marked D were dominant, those marked d dominant within the respective group)

Station	1	2	2	4	4	5	5	6	6	7	8	12	12	13	13	15	17	18	23	24
Depth	0	0	10–0	0	10–0	0	10–0	0	50–0	10–0	0	10–0	50–0	10–0	50–0	25–0	5-0	10–0	10–0	50–0
Radiolarians	.	.	.	.	.	.	.	.	.	.	.	.	D	.	.	.	.	.	.	.
Aulastrum	.	.	.	.	.	.	.	.	×	.	.	.	×	.	×	×	.	×	.	×
Aloscena	.	.	.	.	×	×	.	.	×	.	.	.	×	.	×	×	.	×	.	×
Aulosphaera	.	.	.	.	×	×	.	.	×	.	.	.	×	.	×	×	.	×	.	×
Castanella	.	.	.	.	.	.	.	.	×	.	.	.	.	.	×	.	.	.	.	.
Castanidium	.	.	.	.	.	.	×	.	.	.	.	.	.	.	.	.	.	.	.	.
Castanissa	.	.	.	.	×	.	.	.	×	.	.	.	×	.	×	×	.	.	.	×
Coelodendrum	.	.	.	.	×	×	×	.	.	.	.	.	.	.	.	.	.	.	.	.
Sagenoscena	.	.	.	.	×	×	.	.	×	.	.	×	×	.	×	×	.	×	.	×
Sagoscena	.	.	.	.	×	.	.	.	×	.	.	.	×	.	×	×	.	×	.	.
Siphonophores	.	.	.	.	.	.	.	.	.	D	.	D	.	.	D	D	.	D	.	D
Diphyes truncata	.	.	.	.	.	×	×	.	×	.	.	.	.	.	.	.	.	.	.	.
Muggiaea atlantica	×	.	×	×	d	d	d	×	d	D	d	D	×	×	D	D	d	D	.	D
Nectodroma reticulata	.	.	.	.	.	.	.	.	×	×	×	.	.	.	×	.	.	.	.	.
Sphaeronectes truncata	.	.	.	.	×	.	×	.	×	×	.	.	×	.	×	×	.	.	.	×
Ctenophores	.	.	.	.	D	.	D	.	.	.	.	.	D	.	D	.	.	.	.	.
Pleurobrachia pileus	×	.	×	.	D	×	D	.	×	×	.	×	D	×	D	×	×	×	×	.
Chaetognaths																				
Sagitta bipunctata [1]	×	.	×	×	×	×	×	.	.	×	.	×	×	×	×	×	d	.	×	.
Sagitta hexaptera	.	.	.	.	.	.	.	.	.	.	.	.	.	.	×	.	.	.	.	.
Sagitta lyra	.	.	.	.	.	×	×	.	.	.	.	.	×	.	×	×	×	×	.	.
Sagitta serratodentata	.	.	.	.	×	.	.	.	.	.	.	.	×	.	.	×	.	.	.	.
Copepods	D	D	D	.	.	D	.	D	D	D	.	D	.	D	.	.	.	.	D	.
Acartia	.	d	.	d	.	×	×	D	.	×	×	.	.	×	.	.	×	×	D	D
Aetidius armatus	.	.	.	.	.	.	×	.	.	.	.	.	.	.	.	.	.	.	.	.
Calanus finmarchicus	D	d	D	×	d	D	d	×	D	D	d	D	d	×	d	d	d	d	×	×

[1] See footnote, page 552.

Station	1	2	2	4	4	5	5	6	6	7	8	12	12	13	13	15	17	18	23	24
Depth	0	0	10–0	0	10–0	0	10–0	0	50–0	10–0	0	10–0	50–0	10–0	50–0	25–0	5–0	10–0	10–0	50–0
Eucalanus elongatus	.	.	.	.	×	×	.	×	×	×	.	.	d	.	.	×	×	.	×	.
Euchaeta juv.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	×	.	.	.	.	.
Encheirella pulchra	.	.	.	.	.	.	.	.	.	.	.	.	.	.	×	.	.	.	.	.
Gaetanus juv.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	×
Metridia lucens	.	.	.	.	.	.	.	×	×	.	.	.	.	×	.	.	.	.	×	.
Microcalanus	.	×	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Oithona	.	×	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Pontella	.	.	.	.	.	.	×	.	.	×	d	.	.	.	.	×	×	.	×	.
Rhincalanus nasutus	.	.	.	.	.	.	.	.	.	.	.	.	×	.	.	.	.	.	.	.
Tortanus	×	.	.	×	.	.	×	.	.	.	.	.	.	.	.	.	.	×	.	×
Other copepods	×	d	×	×	×	×	×	×	×	×	×	×	.	×	×	×	×	×	×	×
Many juveniles or Nauplii	×	×	.	×	.	×	.	×	.	.	×	×	.	×	.	.	×	.	×	.
Amphipods																				
Hyperia galba	.	.	.	.	.	×	×	.	×	×	×	×	.	×	.	×	.	.	.	×
Phronimopsis tenella	.	.	.	.	.	.	.	.	×	.	.	.	.	.	×	×	.	.	.	.
Streetsia challengeri	.	.	.	.	.	.	.	.	×	.	.	×	.	.	.	.	.	.	.	.
Tyro pacifica	.	.	.	.	.	.	.	.	×	.	.	.	×	.	.	.	×	.	.	.
Euphausiids																				
Euphausia pacifica	.	.	.	.	.	.	.	.	.	.	.	.	×	.	×	×	×	.	×	.
Thysanoessa spinifera	.	.	.	.	.	.	.	.	.	.	×	.	.	.	.	.	.	.	.	.
Thysanoessa gregaria	.	.	.	.	.	.	.	.	.	.	.	.	×	.	.	.	.	.	.	.
Euphausiid larvae	×	D	×	×	D	×	×	.	D	×	×	×	×	×	.	×	×	.	×	×
Tunicates	.	.	.	D	.	.	.	.	.	.	.	.	.	D	.	.	.	.	.	.
Doliolum	.	.	.	.	.	.	×	.	.	×	.	×	.	.	.	×	.	×	.	.
Oikopleura dioica	×	.	×	D	.	.	.	×	.	×	.	×	.	D	.	×	d	×	.	.
Oikopleura labradorensis	.	.	×	.	×	.	×	.	×	×	×	.	×	.	×	×	.	×	.	×
Oikopleura intermedia?	.	.	×	D	.	.	.	.	.	.	.	.	.	×	.	.	×	.	.	.
Oikopleura juveniles	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	×	.
Decapods																				
Macruran larvae	.	.	.	.	×	×	×	.	×	×	×	×	×	×	×	×	.	×	×	×
Brachyuran larvae	.	.	.	.	×	×	×	.	×	×	×	×	×	×	.	.	×	.	×	×

at one station or another, in combination with small siphonophores (Muggiaea), with Euphausiid larvae, and in combination with Oikopleura, without exception they were relatively scarce wherever Pleurobrachia were notably plentiful. This scarcity no doubt results from the efficiency with which the Pleurobrachia fish with their trailing tentacles.

Our station data do not suggest any definite localization of dominance, by one or another group, in definite parts of the bay — none, in fact, was to be expected in so small an area, and in one the physical state of which is so constantly determined by upwelling. The most that can be said is that copepods and Pleurobrachia were relatively most prominent, at the time, in a rather definitely circumscribed area in the southern part of the bay, out to midway across its mouth, and offshore to the continental slope abreast Point Pinos, and that the three stations where *Oikopleura labradorensis* was prominent (4, 13, 18) were all either near the coast, or in shoal water.

The stations where siphonophores were prominent were so generally distributed that no grouping is possible.

The tows throw no light on the rapidity with which one group or species may replace another in the dominating rôle in Monterey Bay. We can only note that off the Hopkins Marine Station, where Pleurobrachia had dominated at 10–0 meters on July 3 (4), it was but sparsely represented on the seventeenth (15), having been replaced by *Muggiaea atlantica*. In the centre of the bay, however, the plankton at 10–0 meters was of the same general type on the twenty-first (21) as it had been on the tenth (7), Muggiaea dominating on both occasions.

And since the Pleurobrachia taken early in the series averaged in general small, those taken later large, it seems that one generation of this ctenophore grew nearly or quite to maturity in the bay during the first three weeks of July, 1928.

From the negative standpoint, the hauls were made interesting by the scarcity of buoyant fish eggs and of larval fishes, only a scattering of which were noted at any of the stations.

In a situation as open to the ocean as Monterey Bay, the relative importance of immigrants and of endemic inhabitants, in the planktonic community is a matter of interest. In July, 1928, the plankton seems to have been chiefly endemic. Calanus, for example, was multiplying locally (p. 554). Pleurobrachia may be expected to do the same, judging from its faunal status in general. Local reproduction is also established for Muggiaea (p. 551) though invasions on its part may also take place. It seems safe to assume local parentage for the Euphausiid larvae, hence for *Euphausia pacifica* (p. 557). *Oikopleura dioica* is so

nearly universal that there is no warrant for assuming an exotic nursery for the local stock, while *Sagitta bipunctata* is also native to Californian coast waters in general (p. 553).

At the time of our survey we found no planktonic animals quantitatively prominent, for which a distant exotic origin could safely be assumed, for while the few genera of Hyperiid amphipods, other than Hyperia (p. 547), several of the chaetognaths, and the common siphonophores are oceanic, it is probable that their areas of regular production include the immediate offing of the bay, at the depths most favorable for them. Furthermore, no typically tropical species were found,though many of the forms listed — *Rhincalanus* for example — are at home only in moderately high temperatures. On the other hand, the tows showed no distinctively arctic element. *Oikopleura labradorensis* (p. 558), must, however, been regarded as a northern species, in the bay, for this seems near the southern boundary to its regular occurrence. But whether it finds its most southerly breeding station there, or to what degree maintenance of the local stock depends on immigrations from the north, is a question for the future.

The geographic status of the Radiolarians in the bay, as a group, is also to be learned. It is certain, however, that mass immigrations do take place into the bay from offshore at times. Thus, as Mr. E. F. Ricketts informs us, Velella was "cast upon local beaches this spring (1927) by the million." He adds "on an average of two or three times each year we get perfect hordes of medusae, ctenophores and siphonophores in belts of pelagic forms." But while events of this sort are so spectacular that their occurrence has long been recognized at the Hopkins Marine Station, nothing is yet known as to their periodicity, nor of the hydrographic conditions responsible, except that they may be expected to take place when upwelling is least active.

The thermal affinities (subtropical) of Velella, and of its companion visitors, is no indication to the direction from which such incursions come, beyond the evident fact that they are from offshore, because the surface waters out at sea to the northwest as well as to the west and southwest, are considerably warmer than is the immediate offing of Monterey. In fact Velella appears, not infrequently, on the coast as far north as Puget Sound (Bigelow, 1911), and has been reported in abundance to the westward of the Queen Charlotte Islands, in latitude about 52° N (Nichols, 1926).

The epiplankton of Monterey Bay in midsummer may be characterized as temperate boreal, corresponding to the prevailing temperature, with no important elements either of arctic or of tropical nature; as

oceanic, with only small contributions from the coast line; as dominated by species that are at least widespread, if not cosmopolitan, in appropriate temperatures and depths; and as chiefly endemic.

It is not unlikely that animals not represented at all in these July tows may dominate at other seasons; at the times of invasion by offshore plankton this certainly happens. But it is probable that the particular species of copepods, siphonophores, ctenophores, and appendicularians that we found dominant in July constitute the normal basis for the plankton of summer and autumn, for mass production is characteristic of all of them, in other seas. Most of these dominant species play the same rôle in one locality or another in the north Atlantic, the only important exception being the Euphausiid shrimp, *Euphausia pacifica* (p. 557). This close parallel between the planktonic communities of the two oceans, in comparable latitudes and temperatures, contrasts with the littoral animals, and those living on bottom in shoal water.

2. *Notes on the More Prominent Groups*

Coelenterates

An interesting aspect of the zoöplanktonic associations in Monterey Bay at the time is the predominance of the small siphonophores, *Muggiaea atlantica* and *Sphaeronectes truncata*, Muggiaea being far the more plentiful of the pair, in the ratio of about fifteen to one for the stations where random samples were counted.

Muggiaea atlantica is a species of distribution so wide that it is probably cosmopolitan: it has been reported from localities as far apart as the English Channel, the southeastern tropical Pacific, and Japan.[1]

Up to the present, mass production of it had been reported only in the English Channel, near Plymouth, England, where it sometimes appears in great abundance (Cunningham, 1892; Gough, 1905). Apparently it enters the channel as an immigrant from the Bay of Biscay, appearing in waves, at different seasons in different years, from early spring to November, but never passing through the channel to the North Sea (Kramp, 1913). The only data at hand as to it in Monterey Bay, other than our own collections, are information contributed by Mr. E. F. Ricketts of the Pacific Biological Laboratories, Pacific Grove, that it occurs, sporadically, in the bay, in abundance with medusae, ctenophores, and other siphonophores, "on an average of two or three times each year." This would suggest that Muggiaea appears in the bay chiefly as an immigrant from offshore. This the open-

[1] For summary of its distribution, see Moser, 1925.

ness of the bay to the Pacific would favor. But the fact that our catches contained large numbers of sexual gonophores almost certainly belonging to this species, as well as its swimming bells of different sizes, points to active production within the bay at the time as responsible at least in part, for its periods of abundance there. Receipt of very large nectophores from Mr. Ricketts, taken in April (of 1924), with the abundance of detached gonophores in July, 1928 suggests that its period of reproduction extends throughout spring and summer, which is in line with Moser's (1925) account of it as breeding in late summer and early autumn in the English Channel.

Its companion-species *Sphaeronectes truncata* is so widespread in the oceans, North Pacific included, that there is nothing surprising in its presence in Monterey Bay. The discovery of *Nectodroma reticulata* in the bay (table, p. 546) deserves more attention because this is only the third notice of this large siphonophore. Previous records are from the eastern tropical Pacific (Bigelow, 1911), and from the northwestern Pacific between San Francisco and Unalaska (Bigelow, 1913). It was to be expected in Monterey Bay, however, because the collection of the Museum of Comparative Zoölogy contains fragments of it from Friday Harbor, Puget Sound. It is represented in our hauls chiefly by the very characteristic bracts, with portions of the stem. The representation of these shows that its chief centre of abundance in the bay was below 50 meters, as follows: —

Station 7, surface, fragments: 10–0 meters, 1 bract
50–0 meters, many bracts and segments of stem with appendages
Station 8, 270–0 meters, many bracts and segments of stem with appendages
Station 27, 550–0 meters, many bracts and segments of stem with appendages

The tows did not yield a single recognizable nectophore of Nectodroma: any that may have been taken had been mashed beyond recognition. But identification seems assured by the close correspondence between these bracts and those earlier described (Bigelow, 1911, 1913).

An occasional nectophore of some other Prayid, too fragmentary for naming, was also found. But the only other siphonophore definitely identified from the shoal tows is the well known *Diphyes truncata* (table, p. 546). Since this species is cosmopolitan, from subarctic to subantarctic, already recorded from widely separated localities in the Atlantic and in both sides of the North Pacific, including the coasts of British Columbia and Bering Sea, it is to be expected anywhere along the Pacific coast of North America.

Mr. Ricketts also reports long-stemmed siphonophores belonging to the physophorae as appearing in the bay at the times when incursions of other pelagic Coelenterates enter. Velella, specimens of which have been received from him, is also reported, as sometimes cast up on the beaches, in great abundance. And the general conformation of this part of the coast line, with the nearness of the continental edge, makes it likely that most of the holoplanktonic Coelenterates proper to moderate temperatures, in the upper waters of the North Pacific, would be found in the bay, were watch kept for them.

By common report, Monterey Bay also supports a varied list of hydromedusae, while at times the large scyphomedusa *Chrysaora gilberti* appears there in swarms. But apparently their periods of abundance do not fall in midsummer, for the only scyphomedusae seen, or taken, were odd examples of Chrysaora and of Phacellophora, while only a scattering of the smaller medusae (not yet examined) were taken in any of our tows.

Ctenophores

Local and temporary monopolization of the upper waters by *Pleurobrachia pileus* is so familiar an event, wherever, in northern marginal seas, this ctenophore occurs regularly, that its dominance in Monterey Bay calls for no special comment. Pleurobrachia may, in fact, be expected to swarm anywhere along the Californian coast, for Esterly (1914) found it in about 25% of his hauls at La Jolla, where it is the commonest ctenophore, most abundant in August, though he reports it as occurring less commonly there than do either the commonest chaetognath (*Sagitta bipunctata*) or the commonest offshore copepod (*Calanus finmarchicus*).

Chaetognaths

Dominance of the plankton by chaetognaths — a common occurrence in cool coastal waters in the North Atlantic — did not occur at any station in Monterey Bay in July, 1928. But the presence of *Sagitta bipunctata* [1] in all parts of the bay (table, p. 546), and in considerable numbers in most of the hauls, shows that a period of active reproduction for it alone was needed for it to monopolize the upper waters of the

[1] These specimens clearly belong to the species recorded by Michael (1911) under that name, as common off La Jolla. But it is unwise to hazard an opinion as to the relationship of this Pacific species to the Atlantic form to which von Ritter Zahony (1911, 1911a) concludes that this name rightly belongs, without comparison with Atlantic material of the latter.

bay as completely as does its relative *S. elegans* in corresponding situations in the Atlantic. The largest catches of *S. bipunctata* (>50 per haul) were in the southern side of the bay (Stations 1, 4, 5, 15), midway of its mouth (12), and in the offing of the Monterey Peninsula (8, 17). But this species did not occur regularly enough to allow any definite part of the region to be named a center of abundance for it at the time. The few hauls from 50 meters and deeper proved less productive of this Chaetognath than did hauls from 100 meters. Thus at Station 12, the haul from 100 meters yielded fifty, that from 500 meters only two or three. At Station 13, nine were seen in the 10 meter, only one or two in the 50 meter haul, although the latter was made with a net of four times the mouth area of that used for the former. At Station 17, one hundred and fifty were taken near the surface in a net one-half meter in diameter, only eight or nine in a haul from 550–0 meters with 75 cm. net. And at one station (5) it seems to have been more plentiful right at the surface than a few meters down. At another station, however, (8) the numbers from surface and deep (275–0) hauls are roughly equal, when the difference in the mouth areas of the nets is allowed for.

The status of *S. bipunctata* is thus the same in Monterey Bay as off La Jolla, where Michael's (1911) statistical study showed it typically epiplanktonic, most frequent and abundant shoaler than 40 meters. Other sagittae detected in the shoalest hauls (table, p. 546) were represented by occasional examples only. Thus one specimen of *S. serratodentata* was found in the 100 meter tow, Station 4; odd examples of *S. lyra* from that same depth-zone at Stations 5, 17 and 18. Both of these species were better represented in hauls from 500 meters, seven *serratodentata* being recorded from that depth at Station 12, about thirty *lyra* in that same haul, while both of them were much more plentiful in the deep hauls (p. 560). Their vertical distribution is thus essentially the same off Monterey as off La Jolla, where Michael (1911) found them chiefly bathyplanktonic, most abundant near 400 metres, and only occasionally at shallow levels.

Copepods

The following notes on the genera and species of copepods are based on examination by C. V. MacCoy, of random samples. Wherever copepods dominated the tows from 100 or 250 meters, *Calanus finmarchicus* and Acartia were usually chiefly responsible. Exact percentages have not yet been determined, but in most of the hauls from

this depth zone these two together formed more than 50% of the numerical stock of the adult copepods. And wherever juveniles were numerous (table, p. 547), these same copepods were chiefly responsible, so far as the first cursory examination shows. Of the two, Calanus was the more regularly occurrent (in number sufficient for detection in the samples examined) and the more regularly prominent, as appears clearly from the tabulation (p. 547). Furthermore, while Calanus, in significant numbers, was regionally universal in the bay, in fact did not fail at any station, or in any haul so far examined, Acartia was dominant only at stations near land (2, 4) or, if farther out, in comparatively shoal parts of the bay (6, 13, 23, 24).

In this respect, our records, so far as they go, are in line with Esterly's (1912) observations at La Jolla, where *Calanus finmarchicus* is the most numerous copepod out from the land, though Acartia so greatly outnumbers it close to the shore there Calanus "plays no part whatever" in the general community (Esterly, 1928, p. 332). In view of the status of *Calanus finmarchicus* in southern California waters, and of its latitudinal distribution in the Atlantic, to find it occurring regularly in Monterey Bay was to be expected. Thompson (1898) also found it the most plentiful copepod in Puget Sound, to the north, while Campbell (1929a) had it at various localities between Vancouver Island and the mainland. And even in the estuarine waters of San Francisco Bay, Esterly (1924) found it the third, in frequency, among copepods. Off the west coast of Vancouver Island however, also in Bering Sea, and off the Arctic coast of Alaska and Canada, other copepods have been found usually to outnumber Calanus (McMurrich, 1916; Willey, 1920). Present information, therefore, points to the sector from southern California to Puget Sound as the region within which, off the Pacific coast of North America, *Calanus finmarchicus* is relatively the most important as a member of the copepod community. This contrasts with its geographic status in the North Atlantic, where it swarms not only in boreal waters, but in the icy Labrador current, in the northern part of the Norwegian Sea, and up into the polar basin (Sars, 1900).

We made no catch of Calanus in Monterey Bay that would be classed as "large" by the North Atlantic standard, nor did our nets in any case yield the rich and monotonous Calanus plankton that is so frequently encountered in the Gulf of Maine in the one side of the Atlantic, in north European waters in the other. But the abundance of juveniles in several of the hauls (table, p. 547) shows that this copepod —the most important of its group economically in the high seas—was

multiplying actively in Monterey Bay at the time. Thus 50% or more of the copepods in the samples examined by Mr. MacCoy, from the following tows, were early juveniles: no. 1, surface; no. 2, surface; no. 5, surface; no. 8, 300–0 meters; no. 12, 10–0 meters; no. 13, 10–0 meters; no. 23, 10–0 meters. And while the percentage of Calanus among these early stages has not been determined, preliminary examination shows that in most cases it is at least 50%. Furthermore Nauplii, provisionally referred to Calanus, were reported by Mr. MacCoy in the surface tow at Station 2; at 10–0 meters, Station 23. Thus tows taken a few weeks later, when the juveniles of July had grown to subadult or adult size, might well have yielded much larger volumes of Calanus. And if our visit fell at the beginning of a period of multiplication, as the comparative scarcity of large adults suggests, it is probable that the numerical strength of the stock would also have been much greater, in August or early September.

This also applies to copepods as a whole, for other species, as well as *C. finmarchicus*, were strongly represented among the Nauplii and juveniles recorded by Mr. MacCoy. At Station 2 (surface tow), for example, Mr. MacCoy reports an abundance of other Nauplii. As Acartia was about as numerous as Calanus in this tow, they may have belonged to the former.

Therefore, it need not be surprising if Monterey Bay waters are at times as fully monopolized by copepods, or if they support a stock of those little crustaceans as large as do the regions in the North Atlantic where their quantitative occurrence has been studied.

In short, the copepod community, with *Calanus finmarchicus* as the key species and Acartia vying with it, or surpassing it in abundance near land and near the surface, may well play as important a rôle in the natural economy of Monterey Bay as food for the Californian sardine (*Sardina coerulea*) as it does for plankton-feeding fishes, generally, in the two sides of the North Atlantic. Various phases in the life history of Calanus in the bay, such as number of generations a year; numerical strength of the stock from season to season; bathymetric distribution of its different developmental stages, etc., may, therefore prove so important, economically, as to point the need of statistical study of it there, such as Ruud (1929) [1] has recently carried out, in Norway.

Esterly (1923), also describes copepods, as a group, as by far the predominant planktonic animals in surface tows taken daily at the Pier at La Jolla over a period of two years, and as most abundant in

[1] See Ruud (1929) for bibliography of the life history of *Calanus finmarchicus*.

late winter and early spring, though, as just noted, other genera were more numerous than Calanus at this particular location, as might be expected from the shoalness of the tows, and the close vicinity to the tide line.

Among the large adult or subadult macrocopepods, no other species approached *Calanus finmarchicus* and the genus Acartia in importance in the tows from the 10–25 meter depth zone, except at one station (23) where *Metridia lucens* about equaled Calanus in a very sparse population. One of the 50–0 meter tows (12) also gave a showing of the large slender adults of *Eucalanus elongatus* about equal to Calanus, and *Eucalanus* is evidently a characteristic inhabitant of the bay, for it was sparsely represented in most of the subsurface tows, if not in all. In the surface tows, which yielded very few adult Calanus or other large copepods of any sort, other smaller species were relatively numerous. In addition to Acartia, the surface tows yielded a scattering of *Microcalanus*, of Oithona and of other microcopepods still to be examined. In one of the surface tows (8) Pontella dominated, the only occasion when more than a scattering of this genus was taken.

Amphipods

Only one Hyperiid-amphipod, the well-known *Hyperia galba*, was found at more than two of our stations. This is a species of such wide distribution (North Atlantic, Mediterranean, North Pacific), and through so wide a range of depths, that it will probably prove cosmopolitan near land in the temperate and boreal belt of the northern hemisphere.

We may point out, in passing, that in July, 1928, the Hyperia of Monterey Bay were, for the most part, living independently; not sheltering under medusae as they so often do. Although found at most of the stations, the representation was sparse in each case, ca. 25 being the largest number counted in any one tow.

The other Hyperiids taken in the shoal hauls (table, p. 547) are oceanic species, represented by odd individuals only.

The Hyperiid element of the plankton was also made interesting, negatively, by the absence of the genus Euthemisto, which is so often well represented along the edge of the continent off the opposite coast of the United States and of Canada.

Euphausiids

July was a period of reproduction for Euphausiids in Monterey Bay, as well as for copepods: witness the abundance of larvae at Stations 2, 4 and 6, which, while not specifically identified, probably belonged to *Euphausia pacifica*, as the only species, adults of which were then present in any numbers in any of our tows, shoal or deep. Although no adults of this species were taken at either of the stations that yielded many larvae (and only a sparse representation in the 50 meter hauls), the deep hauls made large catches of it (table, p. 560), showing that its centre of abundance in the bay was below the 50 meter level, when adult. *Euphausia pacifica* has already been taken in Monterey waters on several occasions (Hansen, 1913, 1915), and is abundant off La Jolla (Esterly, 1914). First described from the Formosan-Japanese-Corean region, where it is abundant (Hansen, 1911), it is now known to be cosmopolitan offshore in the temperate and boreal parts of the North Pacific, often occurring in shoals.[1] On the American side it has been reported from southern California northward to Alaskan waters, but has not yet been found in the tropical Pacific. Its abundance makes it a species of great economic importance, for, like all its tribe, it is eaten by plankton-feeding fishes — salmon, for instance (Hansen, 1913). The strength of its representation in our deep tows, and the general occurrence and local abundance of Euphausiid larvae in Monterey Bay at the time make it likely that the "shrimp" on which local fishermen report the Californian sardines as feeding at certain times belong largely to this species, as Lewis (1929) has found to be the case off La Jolla.

The only other Euphausiids identified from the shallow hauls (*Thysanoessa gregaria* and *Th. spinifera*) have also been taken off the west coast of North America both to the south of Monterey and to the north (Holmes, 1900; Esterly, 1914, Hansen, 1915). Their presence in Monterey Bay, therefore, needs no further comment.

Decapods

In the shallow tows decapods were represented only by larvae (both Macruran and Brachyuran), which were found at most of the stations (table, p. 547), sometimes in numbers great enough to suggest active production near by. It has not been possible to identify any of these larvae specifically.

[1] For summary of its occurrence, see Hansen, 1915.

Appendicularians

The widespread occurrence of *Oikopleura labradorensis* Lohmann [1] is an interesting feature of the July plankton of the bay, illustrating the favorable environment that the cool updraft provides there for planktonic animals that, in general, are boreal or subarctic. Thus in the North Atlantic *O. Labradorensis* — a well-known species, easily recognized — is widespread from Davis Strait, west Greenland, and Spitzbergen, southward to the junction between Labrador current, and Gulf Stream drift in the one side, to the North Sea in the other, but is not known farther south (Apstein, 1911). But in the eastern Pacific it is not only common at the warmest season in Monterey Bay, at latitude 36° 30′–37°, but is even reported from time to time as far south as the La Jolla region during the cool months (Essenberg, 1926). Essenberg (1926) also found *O. vanhöffeni* there, a form still more typically arctic-subarctic, though it did not appear in our collections.

Off Monterey *O. labradorensis* was for the most part at 10 meters and deeper, i.e., living in temperatures lower than 12°. And since it is most plentiful in temperatures of 12°–13° at La Jolla, 12° may be set as its upper optimum in the northeastern Pacific.

Oikopleura dioica, the only member of its group that was sufficiently abundant to give character to any of our Monterey catches (Station 4, surface; Station 13, 10–0 meters; Station 18, surface), was to be expected regularly there, for it is present the year round at La Jolla (Essenberg, 1926), common in Japanese waters (Aida, 1907), and widespread near land in the Atlantic, as well as in the north and south Pacific and Indian Oceans. It is also known to inhabit a wide range of temperature and of salinity. It occurred chiefly in hauls from 10–0 meters and from the surface, evidence that the highest temperatures existing in the bay at the time (about 14°–15°) were not outside its normal optimum.

One other Oikopleura, apparently identical with *O. intermedia* Lohmann, was recognized in several of the tows (table, p. 547). If this identification be correct, its presence is interesting because this species has not been recorded previously from the Pacific.

This list is short, compared with the varied appendicularian fauna described by Essenberg (1926) for the San Diego region, to the south. But the regional contrast may not actually be as wide as it appears, because other species of Oikopleura, besides those just mentioned, may be represented among the juveniles that occurred in most of our tows.

[1] Identified by Mary Sears.

The seasonal aspect must also be taken into account, for Essenberg found the summer to be the season of minimum variety for this group near La Jolla.

D. Bathyplankton

The planktonic associations grouped under this heading, as existing off Monterey, include two bathymetric groups. One covers those which reach their most abundant development at depths greater than 100, or 150 meters, but which also occur normally, if sparsely, right up to within a few meters of the surface, if not actually at the surface. *Euphausia pacifica* and *Sagitta lyra* are typical examples. Most of the copepods that were taken exclusively in the deep hauls, if not all (table, p. 561), also belong in this bathymetric category.

The other chief group are most abundant somewhat deeper, and do not normally rise above the 100 meter level at this latitude in the eastern side of the North Pacific, unless it be in their larval stages. This is the case with *Eukrohnitta subtilis*, for example (von Ritter Zahony, 1911). Typical examples, represented in our deepest tows, are the deep-sea medusae Atolla, Periphylla, and Colobonema; the siphonophore Chuniphyes; and the chaetognaths Eukrohnia and *Sagitta maxima*. The representation of this group in our hauls is interesting, chiefly as proof that this shadow-plankton exists in full strength right up to the coastal slope of this part of California (hence that it is within easy reach of the Hopkins Marine Station); and that its qualitative composition is much the same there as it is over the Pacific, generally, in low and mid-latitudes.

In interpreting, in bathymetric terms, the occurrence of the various animals identified from these deep hauls, it must also be borne in mind that not all of them — even if taken exclusively by the deep tows — actually belong to the bathyplankton. Some, on the contrary, are members of the epiplankton, picked up near the surface by the net on its way down through the water, or up again. This almost certainly applies to the narcomedusae *Solmundella bitentaculata* and Aegina, both of which have been taken at or near the surface in other parts of the Pacific, on many occasions.

The following tables give particulars of the catches of the deep hauls, so far as these have yet been examined.

Occurrence of Characteristic Species Much More Prominent in the Deep Hauls than in the Shallow Hauls, though Taken in Both Series

	Sta. 8 280–0 m.	Sta. 17 475–0 m.	Sta. 27 550–0 m.
Nectodroma reticulata	D		X
Sagitta lyra	ca. 100	ca. 40	ca 40
Sagitta serratodentata	ca. 50	100	ca. 10
Euphausia pacifica	M	M	M

Occurrence of Representative Species that Were Taken Only in the Deep Hauls

Station Max. depth of haul, meters Av. depth of haul	8 280–0 125	17 475–0 390	27 550–0 275
Radiolarians			
Aulacantha		×	×
Aulagraphis		×	×
Aulatractus			×
Aulospathis			×
Coelographis			×
Sagenoarium			×
Siphonophores			
Clausophyes galatea			×
Chuniphyes multidentata		×	×
Vogtia pentacantha [1]		×	
Scyphomedusae			
Atolla wyvillei		×	×
Periphylla hyacinthina			×
Narcomedusae			
Aegina		×	×
Solmundella bitentaculata		×	
Solmissus incisa	×		×
Trachomedusae			
Halitrephes maasi			×
Colobonema typicum			×
Homoeonema glabrum [2]			×
Chaetognaths			
Eukrohnia hamata	×	×	×

[1] See footnote, p. 564.
[2] See p. 564.

Station Max. depth of haul meters Av. depth of haul	8 280–0 125	17 475–0 390	27 550–0 275
Krohnitta subtilis		×	
Sagitta decipiens [1]	×	×	×
Sagitta maxima		×	×
Sagitta planktonis		×	×
Annelids			
Tomopteris planktonis		×	×
Tomopteris septentrionalis			×
Copepods			
Arietellus setosus			×
Euchaeta elongata		×	×
Euchaeta tonsa			×
Eucheirella galatea		×	×
Eucheirella pulchra		×	×
Eucheirella rostrata	×		
Gaetanus cordani		×	×
Gaidius pungens [2]		×	×
Heterorhabdus spinifrons		×	×
Pleuromamma abdominalis			×
Scolecithrix frontalis			×
Scolecithrix persecans	×		×
Amphipods			
Eupronoe intermedia	×		
Lanceola serrata			×
Orchomena abyssorum			×
Paraphronima gracilis	×	×	
Phronimopsis spinifera	×		
Phronima	×		
Scina		×	×
Vibilia	×	×	
Euphausiids			
Nematoscelis microps	×		
Nematoscelis sp. ?		×	
Thysanoessa spinifera	×	×	
Decapods			
Pasiphaea	×		
Sergestes	×	×	

[1] See footnote, p. 564.

[2] According to A. Scott (1909), *G. pungens* Giesbrecht is a synonym of *G. similis* (T. Scott).

The depths of the hauls tabulated above, as calculated from the angle of the towing wire, show a rather definite stratification within the stratum bounded by the 200 meter and 500 meter levels, as well as between that depth zone as a whole and the upper 50 meters. Thus it was only in the two deepest hauls (475–0 and 550–0 M) that radiolarians were found of genera not also identified from hauls at 50 meters or still nearer the surface (table, p. 546). Strictly bathypelagic siphonophores (Chuniphyes and Vogtia) were also restricted to the deepest hauls; likewise five out of seven species of medusae. The percentage of copepod species recognized only in hauls from deeper than 400 meters was still higher (table, p. 561).

Two bathypelagic species of Sagittae were also taken exclusively in the two deepest tows. On the other hand a tow from 280–0 meters (8) yielded a considerably more varied representation of Hyperiid amphipods than did either of the deeper hauls.

These data, with previous knowledge of the bathymetric occurrence of the species concerned in other parts of the oceans, locate the upper boundary for the most typically bathyplanktonic of the radiolarians, siphonophores, trachomedusae, and scyphomedusae that were taken in any of the tows as lying between 300 and 400 meters depth, off Monterey, by day, in summer. Apparently this also applies to the chaetognaths *Sagitta maxima* and *S. planktonis*.

The case is not so clear for the several species of copepods that were recognized only in the hauls from deeper than 400 meters, because Esterly (1912) found that for at least five of these species,[1] 200 meters was the critical level, above which most of the stock migrate by night, to sink below it again by day. *Euchaeta tonsa* and *Eucheirella galatea* seem, however, to reach their highest development deeper than 200 meters off La Jolla, as well as off Monterey, while no statistical study of vertical distribution has ever been attempted for *Arietellus setosus*, for *Gaetanus cordani* or for *Heterorhabdus spinifrons*, so far as we are aware.

Hjort (1912) from the collections made in the North Atlantic by the "Michael Sars" in 1910, brought out the interesting fact that among the bathyplanktonic communities of animals of the high seas, a transparent-iridescent association of various groups, living the shoaler, can, in a rough way, be distinguished from a deeply pigmented category — the so-called "black fish-red prawn community" — which reaches its chief development considerably the deeper, with its centre of abundance

[1] *Eucheirella pulchra, Gaidius pungens, Pleuromamma abdominalis, Scolecithrix frontalis, Scolecithrix persecans.*

at about 500 meters in the North Atlantic. Subsequent analysis of earlier records has shown that a corresponding separation can be made of the bathyplanktonic medusae on the basis of correspondence between color and vertical distribution (Bigelow, 1911a, 1911b). In the eastern tropical Pacific, tows by the "Albatross" at the 600 meter level yielded a rich representation of both these categories, whether of fish, of crustacea, or of medusae. But the great majority of the bathypelagic animals taken in the tows from 475–0, and 550–0 meters off Monterey in July, 1928, belonged to the transparent-iridescent group. Thus seven species of medusae included only two of the red-black group (Atolla and Periphylla) and each of these was represented by a single juvenile specimen. The two bathypelagic siphonophores that were taken only in our deepest tows (Chuniphyes and Vogtia) are also transparent-iridescent, nor were any of the typically abyssal species of Pterophysa or Rhizophysidae taken, though a specimen of *Pterophysa grandis* Fewkes, picked up on a dredging wire, off Monterey, has been received from Mr. E. F. Ricketts.

Perhaps still more significant is the fact that even the deepest tows yielded none of the deeply pigmented red prawns so characteristic of the deep strata in the Atlantic, and Pacific as well, while the velvety-black bathypelagic fishes were represented only by odd specimens of a species (*Myctophum glaciale*) that is often taken in still shoaler hauls in the North Atlantic.

Our hauls, though so few in number, thus show that in the offing of Monterey the deeply pigmented community finds the upper boundary to its optimum depth-zone at a depth greater than 500 meters, except in early stages in development. This agrees in general with its vertical occurrence in corresponding latitudes in the North Atlantic.

The center of abundance for the transparent-iridescent community also lay at about the same depth off Monterey as in mid-latitudes in the North Atlantic — 300–500 meters by day — for our two deepest hauls yielded a list of species decidedly varied (table, p. 560) for tows too short (one-half hour) for more than rough sampling at so great a depth.

The data do not establish the upper limit to the regular occurrence of this community at the time and place, for the comparatively poor representation of it in the 280–0 meter haul may have been a matter of chance: a considerable number of hauls from the stratum between 100 and 250 meters would have been needed, for this purpose.

The capture of the particular species listed above (table, p. 560), is interesting chiefly as corroborating the general thesis that most of the

members of the bathyplankton are cosmopolitan, in mid-depths, in the oceans, a rule already sufficiently established for many of them. Thus among the siphonophores, *Chuniphyes multidentata* and Vogtia,[1] the scyphomedusae *Atolla wyvillei* and *Periphylla hyacinthina*, the narcomedusa *Solmissus incisa*, were all to be expected off Monterey Bay, for all of them have already been reported in the northeastern Pacific to the north, as well as in the eastern side of the South Pacific; as well as widespread in the Atlantic. The status of *Homoeonema glabrum* is probably the same, for while it has been definitely reported only from the tropical Atlantic and Indian Oceans under this name, examination of the present series suggests identity with the form from the southeastern Pacific recorded (Bigelow 1909) as *H. alba* Vanhöffen. *Halitrephes maasi* Bigelow was originally described from the southeastern Pacific, hence is also widespread in that ocean. Of the chaetognaths taken in our deep hauls, Michael (1911) found *Eukrohnia hamata*, *Krohnitta subtilis*, and *Sagitta planktonis* frequent in the bathyplankton (occasional at the surface) off La Jolla, California. The first of these ranges from arctic to antarctic in the Atlantic, being confined to the bathyplankton in low and mid-latitudes, but extending its range upward indifferently to the surface in high. The known range of *K. subtilis* also includes the Atlantic, south to the Antarctic, while previous records for *S. planktonis* are from the North and South Atlantic North and South Pacific, Malaysia, Indian Ocean, and Antarctic. The discovery of *Sagitta maxima* off Monterey confirms von Ritter Zahony's (1911) expectation that it would eventually be found in the Pacific, and occupying the same bathymetric zone there as in the Atlantic, where it is typical of the bathyplankton from subarctic to subantarctic. It is also recorded from the Indian Ocean. *S. decipiens*[2] has likewise been taken in deep hauls at so many stations in the North and South Atlantic, in the Red Sea, in the Indian Ocean, and among the Malay Archipelago that it seems equally cosmopolitan in moderate latitudes, though apparently it does not extend to such high latitudes, in either hemisphere.[3]

Locality records for the two bathypelagic species of Tomopteris recognized in the deep hauls (table, p. 561) recently summarized by Huntsman (1920), show them to be equally widespread: one of them (*T. septentrionalis*) has already been reported off La Jolla (Treadwell,

[1] This is the species reported from Bering Sea by Bigelow (1913) as *V. pentacantha* Kölliker but which Moser (1916) believes to be referable to her new *V. serrata*.

[2] Von Ritter Zahoney (1911) points out that *S. sibogae* Fowler is a synonym of this species.

[3] For general summaries of the known distribution of the chaetognaths, see von Ritter Zahony (1911), Apstein (1911), and Huntsman (1919).

1914). But none of the new species of this group of pelagic worms that Chamberlain (1919) described from the southeastern Pacific have been recognized in our catches, though some may be represented among the more fragmentary specimens.

All of the species of copepods that were recognized exclusively in the three deep hauls have also long been known to be widespread in the Atlantic, except for *Euchaeta elongata*, a species described by Esterly (1913) from the La Jolla region. Most of them have also been reported elsewhere in the Pacific, likewise in Indo-Malaysian waters, hence are no doubt cosmopolitan in the bathyplankton and lower epiplankton. All of them have already been reported off southern California by Esterly (1905, 1912), with the exception of *Gaetanus cordani*.

The quantitive relationship of the different groups and species in the deeper strata off Monterey also deserves brief notice. In the haul from 280 meters (8), more than two thirds of the catch consisted of fragments of the siphonophore *Nectodroma reticulata*. And as one of the deeper hauls (17) failed to pick up a single fragment while the other (27) took a mass of it, the 300 meter level seems to have marked the lower limit to its abundant occurrence at the time.

One of the deeper tows (27) yielded chiefly *Euphausia pacifica*, Nectodroma, and medusae (most of them too battered for identification), the former being much the more numerous, though the latter formed the bulk of the catch because of their larger size: *Solmissus incisa* in particular. This haul was also notable for the considerable catch of *Sagitta decipiens*, likewise for the large variety of radiolarians and of copepods.

The tow from about the same depth at Station 17 was similarly characterized by an abundance of *Euphausia pacifica* (but no Nectodroma, and few medusae), while the several species of chaetognaths appeared in about the same ratio at the two stations, as appears from the following proportionate numbers in random samples.

	Sta. 17	Sta. 27
Sagitta bipunctata	ca. 10	4
Sagitta decipiens	> 100	>150
Sagitta lyra	ca. 40	ca. 40
Sagitta maxima	ca. 40	ca. 40
Sagitta planktonis	ca. 15	ca. 20
Sagitta serratodentata	<100	ca. 10
Eukrohnia hamata	ca. 50	ca. 10
Krohnitta subtilis	6	0

But while Station 27 yielded twelve superior and fourteen inferior nectophores of *Chuniphyes multidentata*, only two nectophores of this bathyplanktonic siphonophore were found in the tow from about the same depth at Station 17.

The great variety of copepods in the deepest hauls (17, 27) contrasting with the predominance of one, or at most a few species within this group in the upper waters (p. 553), illustrated by the following table of percentages, based on random samples identified by C. V. MacCoy, is a state typical of the bathyplankton in general.

	Sta. 17 475–0 m.	Sta. 27 550–0 m.
Arietellus setosus	0	1
Calanus finmarchicus	38	2
Eucalanus elongatus	12	14
Euchaeta tonsa		7
juveniles	6	30
Eucheirella galatea	2	8
pulchra	6	4
Gaetanus cordani	2	2
Gaidius pungens	22	6
Heterorhabdus spinifrons	10	5
Pleuromamma abdominalis		2
Scolecithrix frontalis		2
persecans		2

In the 280–0 meter haul at Station 8, however, *Calanus finmarchicus* formed 90% of the large adult copepods in one sample examined by Mr. MacCoy, with a scattering of the other species listed above (table, p. 561) for that station.

The presence of this bathyplanktonic association of animals in the deep mouth of Monterey Bay, in depths no greater than 300–500 meters, with the fact that shoal hauls did not take any of its most representative members, is evidence that upwelling is not active enough to raise their upper boundary much nearer to the surface there than it is in other seas at corresponding latitudes. And this is in line with the very low velocity (30 m. per month) calculated for the updraft off San Diego by McEwen (1919, p. 378, 415; 1929, p. 258).

The fact that so varied a community exists in the depth zone in question, in this particular part of the Pacific, is also interesting, in connection with the very low values of dissolved oxygen at that depth

(p. 515). This is in line with Schmidt's (1925) discovery of an abundant bathyplanktonic fauna in mid-depths in the Gulf of Panama where the water was less than 5% saturated with oxygen, and corroborates his conclusion that a "wealth of bathypelagic animal life can exist in waters of a lower oxygen content than we had reason to suppose" (Schmidt, 1925, p. 593).

Schmidt gives no data as to the relative abundance of different groups. The Monterey tows are, therefore, the more welcome as showing that a paucity of oxygen is certainly no barrier to what are usually termed the lower groups (because morphologically the least complex) siphonophores, medusae, or chaetognaths. But it may be significant that none of our deep hauls yielded more than an odd fish of any species, and very few decapod crustacea.

VIII. Table of Stations, Temperatures, Salinities, Densities,[1] Silicates, Phosphates and Nitrates

Temperature is in degrees centigrade, salinity in parts per thousand, and density at the temperature *in situ*, but without correction for compression. For the latter, see Ekman (1910) and Bigelow (1927).

Silicates as SiO_2, phosphates as P_2O_5, and nitrates as NO_3, are stated in milligrams per liter. Oxygen is expressed both as cubic centimeters of O_2 per liter and as percentage saturation. For discussion of standards of accuracy, see p. 431.

Sta.	Date 1928	Position	Depth	Temp.	Sal.	Density	SiO_2	P_2O_5	NO_3
1	June 30	36°38.8′N. 121°56.5′W.	0	13.3	33.87	25.47			
2	June 30	36°37′ N. 121°52.5′W.	0	13.9	33.87	25.35			
3	July 2	36°41.5′N. 121°49.3′W.	0	14.2	33.84	25.27			
4	July 3	36°38′ N. 121°53.8′W.	0	14.0	33.87	25.34			
			25	9.9	33.95	26.17			
			50	9.1	34.00	26.36			

[1] (Specific gravity — 1) ×1000.

Sta.	Date 1928	Position	Depth	Temp.	Sal.	Density	SiO_2	P_2O_5	NO_3
			0	12.1					
5	July 5	36°38.6′N.	25	9.1	33.95	26.30			
		121°57′ W.	50	9.1	33.96	26.31			
			0	11.8	33.84	25.75			
			25	9.2	33.87	26.22			
6	July 9	36°43′ N.	50	9.0	33.96	26.32			
		121°54′ W.	75	8.9	33.98	26.37			
			100	8.8					
			0	12.1	33.80	25.67	0.78	0.054	0.08
			10	11.5	33.84	25.81	0.76	0.07	
		36°44′ N.	25	9.5	33.86	26.16	1.39	0.15	
7	July 10	121°59.5′W.	50	9.1	33.95	26.30	1.56	0.152	
			100	9.1	33.96	26.31	1.52	0.167	
			150	8.7	33.98	26.34	1.52	0.153	
			200	8.5	34.05	26.48	1.61	0.193	
			0	12.2	33.87	25.69	0.446	0.046	
			5	11.8	33.89	25.79	0.770	0.058	
			10	11.2	33.87	25.89	0.650	0.088	
			25	10.8	33.89	25.98	0.971	0.096	
8	July 11	36°38.5′N.	50	9.5	33.89	26.17	1.376	0.147	
		122°02.5′W.	100	8.9	33.98	26.35	2.083	0.146	
			200	8.2	34.09	26.55	2.410	0.153	
			300	7.6	34.16	26.64	2.680	0.167	
			400	6.8	34.20	26.83	2.912	0.185	
			0	13.6	33.87	25.41	0.286	0.012	
			10	11.8	33.87	25.77	0.588	0.050	
		36°47.5′N.	25	10.0	33.84	26.07	1.363	0.123	
9	July 12	121°52′ W.	50	9.3	33.93	26.25	1.500	0.125	
			100	9.0	33.96	26.32	1.596	0.196	
			200	8.3	34.04	26.50	2.041	0.142	
			0	13.1	33.86	25.51	0.283	0.027	0.038
			5	12.8	33.80	25.52	0.495	0.026	
			10	12.4			0.424	0.046	
			25	10.5	33.87	26.00	1.082	0.102	
10	July 13	36°46.8′N.	50	9.3			1.264	0.133	
		122°01′ W.	100	8.7	34.04	26.43	1.887	0.150	
			300	7.6			2.083	0.170	
			400	6.9	34.18	26.81	2.440	0.175	
			600	5.3	34.29	27.10	3.570	0.196	

Sta.	Date 1928	Position	Depth	Temp.	Sal.	Density	SiO_2	P_2O_5	NO_3
12	July 14	36°48.5′N. 122°02′ W.	0	13.1	33.91	25.56	0.263	0.017	0.013
			5	12.1	33.78	25.64	0.457	0.064	
			10	11.6	33.82	25.77	0.714	0.071	0.075
			25	9.7	33.73	26.03	1.240	0.118	0.136
			50	9.3	33.96	26.27	1.688	0.156	0.136
			100	8.6	34.05	26.45	1.766	0.156	0.292
13	July 16	36°41.5′N. 121°58′ W.	0	13.3	33.87	25.46	0.143	0.017	
			5	13.1	33.87	25.51	0.141	0.016	
			10	12.2	33.86	25.68	0.303	0.023	
			20	10.1	33.87	26.07	1.096	0.091	
			30	9.7	33.89	26.15	1.340	0.123	
			40	9.7	33.93	26.19	1.442	0.125	
			50	9.5	33.93	26.21	1.250	0.163	
			100	8.7	34.04	26.44	1.949	0.171	
14	July 16	36°38.8′N. 121°56.5′W.	0	12.8			0.377	0.020	
			5	12.5	33.87	25.63	0.411	0.018	
			10	12.5	33.91	25.66	0.400	0.022	
			25	9.8	33.98	26.21	1.456	0.114	
			50	9.6	34.00	26.26	1.563	0.153	
15	July 17	36°37.8′N. 121°53.8′W.	0	14.2	33.87	25.30	0.238	0.010	
			5	13.8	33.87	25.37	0.213	0.011	
			10	13.1	33.87	25.51	0.215	0.010	
			25	10.3	33.89	26.05	1.087	0.118	
			50	9.9	33.91	26.13	1.376	0.138	
16	July 17	36°41.5′N. 121°51′ W.	0	13.6	33.87	25.41	0.204	0.009	0.161
			5	13.2	33.87	25.48	0.196	0.010	
			10	11.5	33.87	25.81	0.862	0.087	
			25	10.2	33.87	26.05	1.163	0.109	
			50	9.7	33.93	26.18	1.442	0.140	0.174
17	July 18	36°38.5′N. 122°08.5′W.	0	12.5	33.86	25.62	0.390	0.060	0.071
			5	12.3	33.86	25.67	0.400	0.060	
			10	12.3	33.86	25.66	0.472	0.054	
			15	11.8	33.86	25.77	0.618	0.090	0.094
			25	9.1	33.86	26.24	1.000	0.120	0.151
			50	9.4	33.95	26.26	1.190	0.135	0.174
			100	8.8	34.02	26.40	1.470	0.134	0.181
			200	8.3	34.11	26.55	1.688	0.179	0.197
			600	5.5	34.29	27.07	3.060	0.217	0.266

Sta.	Date 1928	Position	Depth	Temp.	Sal.	Density	SiO_2	P_2O_5	NO_3
18	July 19	36°52′ N. 121°55′ W.	0	13.1	33.84	25.50	0.193		0.015
			5	12.5	33.84	25.61	0.260	0.019	
			10	12.1	33.80	25.66	0.290	0.022	
			15	11.6	33.82	25.77	0.538	0.030	
			25	9.9	33.71	26.03	1.020	0.124	
			50	9.4	33.91	26.22	1.442	0.143	0.161
19	July 19	36°48.2′N. 121°48′ W.	0	13.6	33.86	25.40	0.300	0.023	0.027
			5	13.3	33.86	25.45	0.295	0.015	
			10	12.7	33.87	25.59	0.291	0.021	
			15	12.3	33.87	25.66	0.610	0.031	
			25	11.7	33.87	25.79	0.833	0.081	
			50	9.6	33.93	26.20	1.905	0.143	
			100	7.9	34.00	26.52	2.410	0.168	0.174
20	July 20	36°50.5′N. 121°59′ W.	0	13.2	33.86	25.49			
			25	9.6	33.91	26.18			
			50	9.2	33.91	26.25			
			75	9.0	33.95	26.30			
21	July 21	36°44.5′N. 121°59′ W.	0	12.6	33.86	25.60	0.562	0.046	0
22	July 21	36°47′ N. 121° 0.5′W.	0	12.5	33.87	25.63	0.618	0.067	0
23	July 21	36°50.2′N. 122° 2.5′W.	0	12.7	33.87	25.59	0.490	0.031	0
24	July 21	36°53′ N. 122° 4.5′W.	0	13.6	33.87	25.41	0.413	0.018	0.008
			5	13.1	33.87	25.50	0.562	0.016	0.013
			10	12.7	33.87	25.58	0.439	0.023	0.038
			15	12.7	33.87	25.58	0.458	0.028	0.021
			25	9.9	33.87	26.11	1.531	0.133	0.174
			50	9.4	33.93	26.23	1.631	0.149	0.174
			70	9.3	33.93	26.26	1.650	0.156	0.151
25	July 21	36°56.7′N. 122° 6.5′W.	0	14.2	33.91	25.33			
			5	13.3	33.91	25.50			
			10	13.1	33.91	25.55			
			15	10.9	33.91	25.96			
			30	10.0	33.93	26.14			

Sta.	Date 1928	Position	Depth	Temp.	Sal.	Density	SiO_2	P_2O_5	NO_3
			0	15.8	33.87	24.94			
			5	13.0	33.87	25.54			
26	July 21	36°56.2′N.	10	11.5	33.87	25.82			
		121°58′ W.	15	10.2	33.87	26.05			
			20	10.3	33.89	26.05			
			0	13.5	33.86	25.43	0.476		0.018
			5	11.9	33.87	25.75	0.618	0.061	0.129
			10	11.9	33.87	25.74	0.595	0.075	0.141
			15	11.7	33.87	25.78	0.582	0.087	0.108
27	July 23	36°42.5′N.	25	10.5	33.87	26.00	0.603	0.118	0.137
		122° 0.5′W.	50	9.9	33.91	26.14	1.127	0.118	0.178
			100	9.1	33.96	26.31	1.579	0.154	0.188
			200	8.4	34.09	26.52	1.631	0.160	0.158
			600	5.5	34.29	27.07	3.190	0.208	0.263
			0	12.4	33.89	25.67	0.715	0.069	0.119
			5	11.1	33.91	25.94	0.747	0.061	0.161
28	July 23	36°38.8′N.	10	11.1	33.91	25.94	0.880	0.080	0.133
		121°56.5′W.	25	10.8	33.93	25.99	2.308	0.115	0.161
			50	9.8	33.96	26.19	1.876	0.144	0.178
			0	12.4	33.80	25.60	0.770		0.133
			5	11.6					
			10	10.9					
			15	10.7					
29	July 24	36°46′ N.	20	10.7					
		121°58′ W.	25	10.6	33.87	25.98	1.042		
			100	9.4	33.98	26.28	1.376		
			250	8.2	34.13	26.57	1.725		
			500	6.2	34.25	26.92	2.810		0.251

Table of Oxygen Determinations

I. *Serial Determinations*

Sta.	Depth	Oxygen (O_2) cc. per liter	Oxygen (O_2) % sat.
20	0	6.66	111.5
	25	2.99	46.9
	50	2.57	40.0
	75	2.38	36.8
29	0	5.20	85.7
	5	5.13	83.4
	10	4.26	68.3
	15	4.17	66.7
	20	4.17	66.7
	25	4.00	63.9
	100	2.46	38.3
	250	1.49	22.7
	500	0.63	9.2

II. *Additional Determinations at the Surface*

Date	Lat.	Long.	Temp.	O_2 cc. per liter	O_2 % sat.	Sal.
July 20	36°41.8′	121°57′		6.14		33.82
	36°44.5′	121°57.8′	12.4	5.65	92.9	
	36°47.5′	121°58.5′	12.5	6.10	100.1	
	36°50.5′	121°59′	13.2	6.66	111.5	33.86
	36°53.5′	122°00′	13.6	6.37	107.7	33.87
	36°55.2′	122° 0.5′	14.9	6.74	116.6	33.89
	36°37.6′	122°53.8′	14.9	6.80	117.8	33.91
July 24	36°43′	121°54′	13.9	7.33	124.5	

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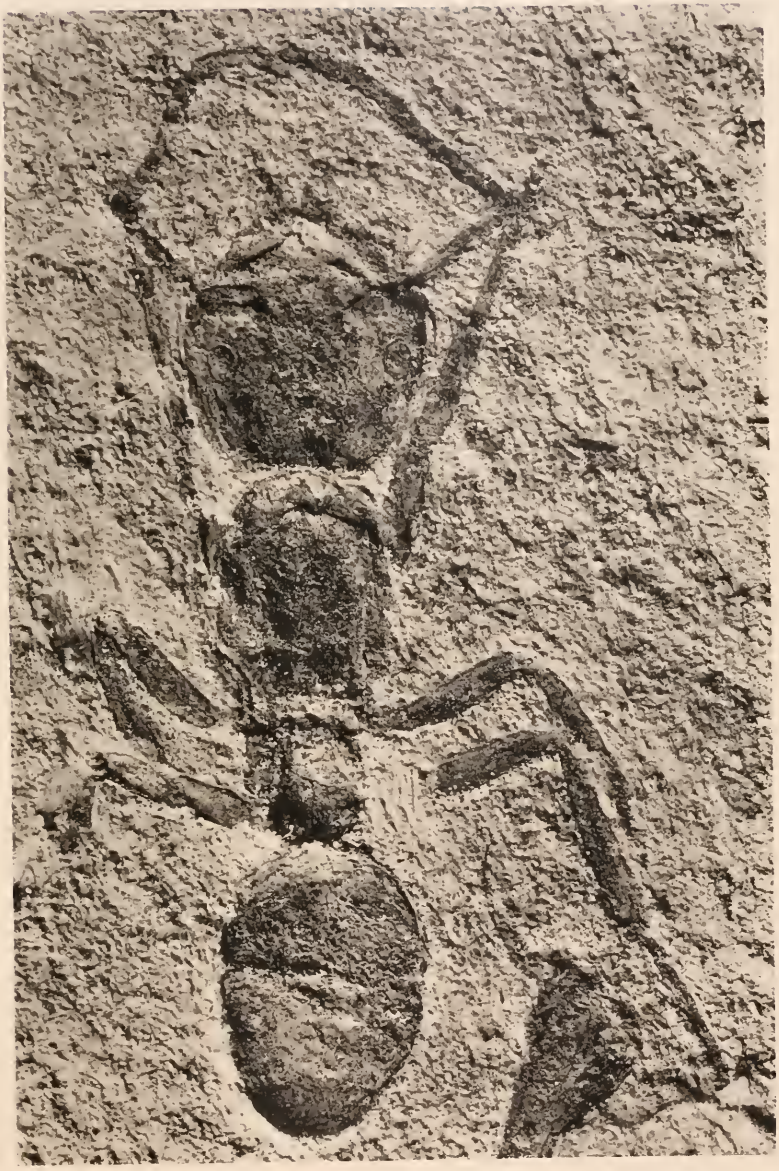
EXPLANATION OF PLATES

PLATE 1

PLATE 1

Archiponera wheeleri, sp. nov., Florissant, Colorado. Obverse of holotype. (♀). × 8. Note eyes, clypeus, mandibles, and abdominal constriction.



HELIOTYPE CO. BOSTON

PLATE 2

PLATE 2

Fig. 1. *Archiponera wheeleri*, sp. nov., Florissant. Reverse of holotype. (☿). × 4.5.

Fig. 2. *Pseudocamponotus elkoanus*, sp. nov., Elko, Nevada. Holotype. (♀). × 5.

Fig. 3. *Protazteca elongata*, sp. nov., Florissant, Colorado. Obverse of holotype. (♀). × 4.

Fig. 4. *Iridomyrmex florissantius*, sp. nov., Florissant. Obverse of holotype. (♀). × 6.

Fig. 5. *Archimyrmex rostratus* Ckll., Green River shales, Roan Mountain, Colorado. Reverse of holotype. (☿). × 2.5.

Fig. 6. *Eoformica pingue* (Scudder), Green River shales, White River, Utah. Homotype no. 19. (♂). × 6.

Fig. 7. *Miomyrmex impactus* (Ckll.), Florissant, Colorado. Obverse of homotype no. 2857. (♀). × 3.

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HELIOTYPE CO. BOSTON

PLATE 3

PLATE 3

Fig. 1. *Protazteca quadrata*, sp. nov., Florissant. Obverse of holotype. (♀). × 5.
Fig. 2. *Elaeomyrmex coloradensis*, sp. nov., Florissant. Holotype. (♀). × 6.
Fig. 3. *Protazteca capitata*, sp. nov., Florissant. Obverse of holotype. (♀). × 3.5.
Fig. 4. *Pseudomyrma extincta*, sp. nov., Florissant. Holotype. (♀). × 5.
Fig. 5. *Mianeuretus mirabilis*, sp. nov., Florissant. Holotype. (♀). × 5.
Fig. 6. *Liometopum miocenicum*, sp. nov., Florissant. Obverse of holotype. (♀). × 3.5.
Fig. 7. *Elaeomyrmex gracilis*, sp. nov., Florissant. Obverse of holotype. (♀). × 4.

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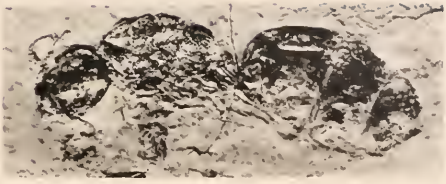
HELIOTYPE CO. BOSTON

PLATE 4

PLATE 4

Fig. 1. *Dolichoderus rohweri*, sp. nov., Florissant. Observe of holotype. (♀). × 9.
Fig. 2. *Petraeomyrmex minimus*, sp. nov., Florissant. Obverse of holotype. (♂). × 10.
Fig. 3. *Formica cockerelli*, sp. nov., Florissant. Obverse of holotype. (♀). × 3.
Fig. 4. *Liometopum scudderi*, sp. nov., Florissant. Holotype. (♀). × 5.5.
Fig. 5. *Messor sculpturatus*, sp. nov., Florissant. Holotypes. (♀). × 5.5
Fig. 6. *Dolichoderus antiquus*, sp. nov., Florissant. Obverse of holotype. (♀). × 6.



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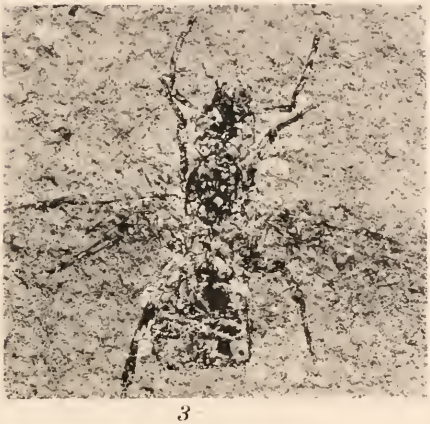

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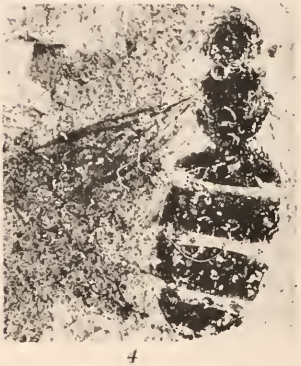

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HELIOTYPE CO. BOSTON

PLATE 5

PLATE 5

Fig. 1. *Lithomyrmex rugosus*, sp. nov., Florissant. Paratype no. 17,019a. (♀). × 5.5.
Fig. 2. *Pheidole tertiaria*, sp. nov., Florissant. Holotype. (♀). × 7.
Fig. 3. *Lithomyrmex rugosus*, sp. nov., Florissant. Obverse of holotype. (♀). × 5.5.
Fig. 4. *Camponotus fuscipennis*, sp. nov., Florissant. Holotype. (♀). × 6.
Fig. 5. *Aphaenogaster mayri*, sp. nov., Florissant. Holotype. (♀). × 5.
Fig. 6. *Lasius peritulus* (Ckll.), Florissant. Allotype. (♀). × 5.

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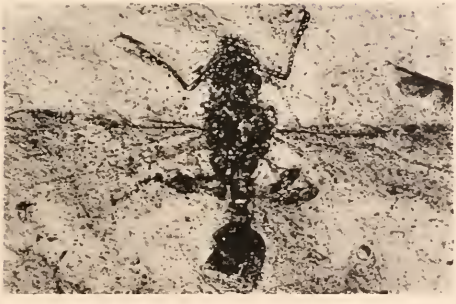

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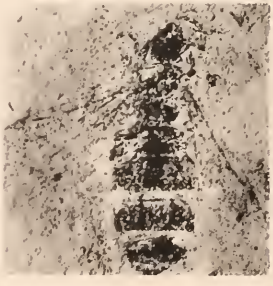

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HELIOTYPE CO. BOSTON

PLATE 6

PLATE 6

Fig. 1. *Lithomyrmex striatus*, sp. nov., Florissant. Holotype. (♀). × 7.
Fig. 2. *Elaeomyrmex gracilis*, sp. nov., Florissant. Ergatotype. × 6.
Fig. 3. *Formica grandis*, sp. nov., Florissant. Holotype. (♀). × 3.5.
Fig. 4. *Camponotus microcephalus*, sp. nov., Florissant. Holotype. (♀). × 5.
Fig. 5. *Camponotus petrifactus*, sp. nov., Florissant. Holotype. (☿). × 4.
Fig. 6. *Formica robusta*, sp. nov., Florissant. Holotype. (♀). × 4.
Fig. 7. *Protazteca quadrata*, sp. nov., Florissant. Ergatotype. × 4.5.

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HELIOTYPE CO. BOSTON

PLATE 7

PLATE 7

Fig. 1. *Miomyrmex impactus* (Ckll.), Florissant. Ergatotype. × 5.
Fig. 2. *Miomyrmex impactus* (Ckll.), Florissant. Allotype. (♂). × 2.5.
Fig. 3. *Aphaenogaster mayri*, sp. nov., Florissant. Allotype. (♂). × 8.
Fig. 4. *Aphaenogaster donisthorpei*, sp. nov., Florissant. Holotype. (♀). × 7.5.
Fig. 5. *Cephalomyrmex rotundatus*, sp nov., Florissant. Holotype. (♀). × 8.
Fig. 6. *Formica robusta*, sp. nov., Florissant. Allotype. (♂). × 5.
Fig. 7. *Lasius peritulus* (Ckll.), Florissant. Specimen no. 2896. (♂). × 8.

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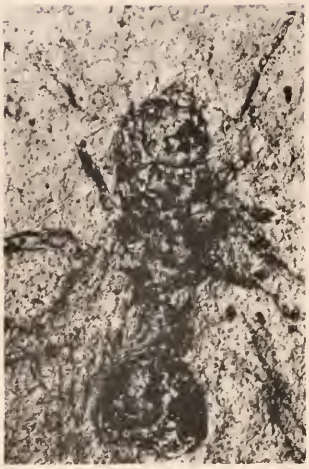

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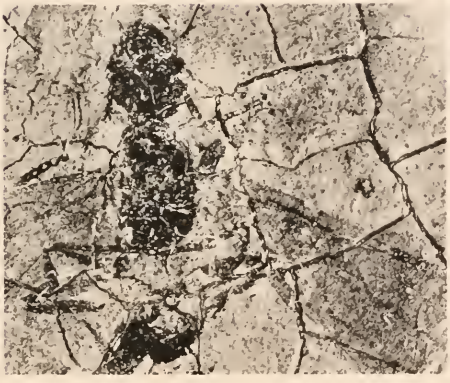

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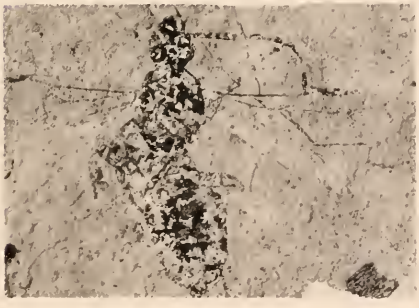

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HELIOTYPE CO. BOSTON

PLATE 8

PLATE 8

Fig. 1. *Archiponera wheeleri*, sp. nov., Florissant. Allotype. (♂). × 3.
Fig. 2. *Lithomyrmex rugosus*, sp. nov., Florissant. Allotype. (♂). × 5.
Fig. 3. *Liometopum miocenicum*, sp. nov., Florissant. Allotype. (♂). × 4.
Fig. 4. *Aphaenogaster mayri*, sp. nov., Florissant. Paratype no. 2912a. (♀). ×8.5.
Fig. 5. *Protazteca clongata*, sp. nov., Florissant. Allotype. (♂). × 7.
Fig. 6. *Miomyrmex striatus*, sp. nov., Florissant. Allotype. (♂). × 5.

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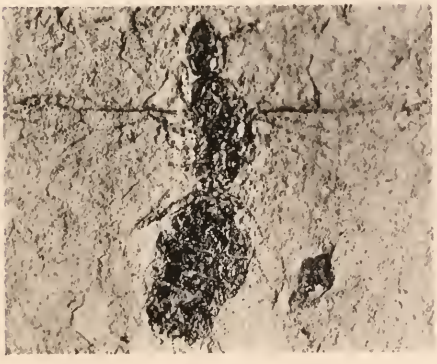

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HELIOTYPE CO. BOSTON

PLATE 9

PLATE 9

Fig. 1. *Dolichoderus antiquus*, sp. nov., Florissant. Ergatotype. × 10.
Fig. 2. *Elaeomyrmex coloradensis*, sp. nov., Florissant. Ergatotype. × 7.
Fig. 3. *Protazteca elongata*, sp. nov., Florissant. Ergatotype. × 7.
Fig. 4. *Liometopum scudderi*, sp. nov., Florissant. Ergatotype. × 10.
Fig. 5. *Aphaenogaster mayri*, sp. nov., Florissant. Ergatotype. × 7.
Fig. 6. *Pogonomyrmex fossilis*, sp. nov., Florissant. Holotype. (♀). × 7.
Fig. 7. *Dolichoderus rohweri*, sp. nov., Florissant. Ergatotype. × 10.
Fig. 8. *Liometopum miocenicum*, sp. nov., Florissant. Ergatotype. × 6.
Fig. 9. *Lithomyrmex striatus*, sp. nov., Florissant. Ergatotype. × 6.
Fig. 10. *Protazteca capitata*, sp. nov., Florissant. Ergatotype. × 6.

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HELIOTYPE CO. BOSTON

PLATE 10

PLATE 10

Fig. 1. *Mianeuretus mirabilis*, sp. nov. ♀.
Fig. 2. *Dolichoderus antiquus*, sp. nov. ♀.
Fig. 3. *Dolichoderus rohweri*, sp. nov. ♀.
Fig. 4. *Protazteca elongata*, sp. nov. ♀.
Fig. 5. *Protazteca quadrata*, sp. nov. ♀.
Fig. 6. *Miomyrmex impactus* (Ckll.). ♀.
Fig. 7. *Iridomyrmex florissantius*, sp. nov. ♀.
Fig. 8. *Liometopum miocenicum*, sp. nov. Head. ♂.
Fig. 9. *Miomyrmex striatus*, sp. nov. Head. ♂.
Fig. 10. *Cephalomyrmex rotundatus*, sp. nov. ♀.
Fig. 11. *Miomyrmex impactus* (Ckll.). ☿.

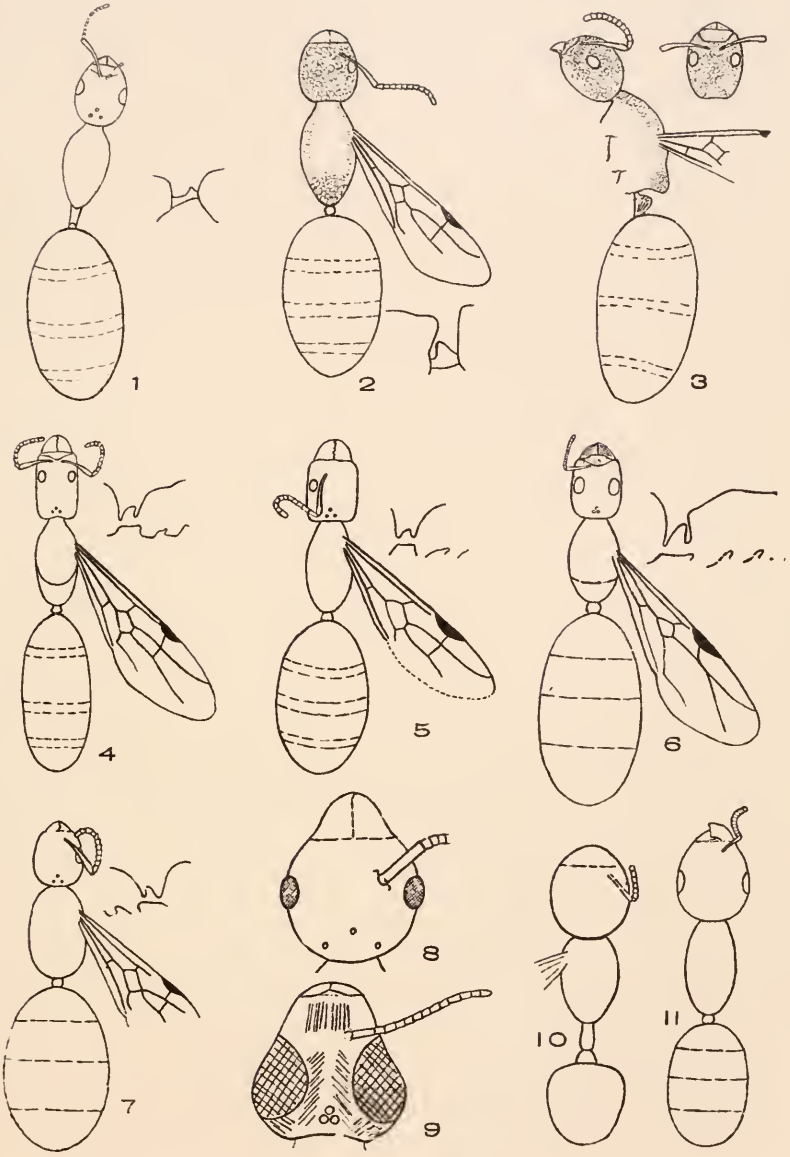
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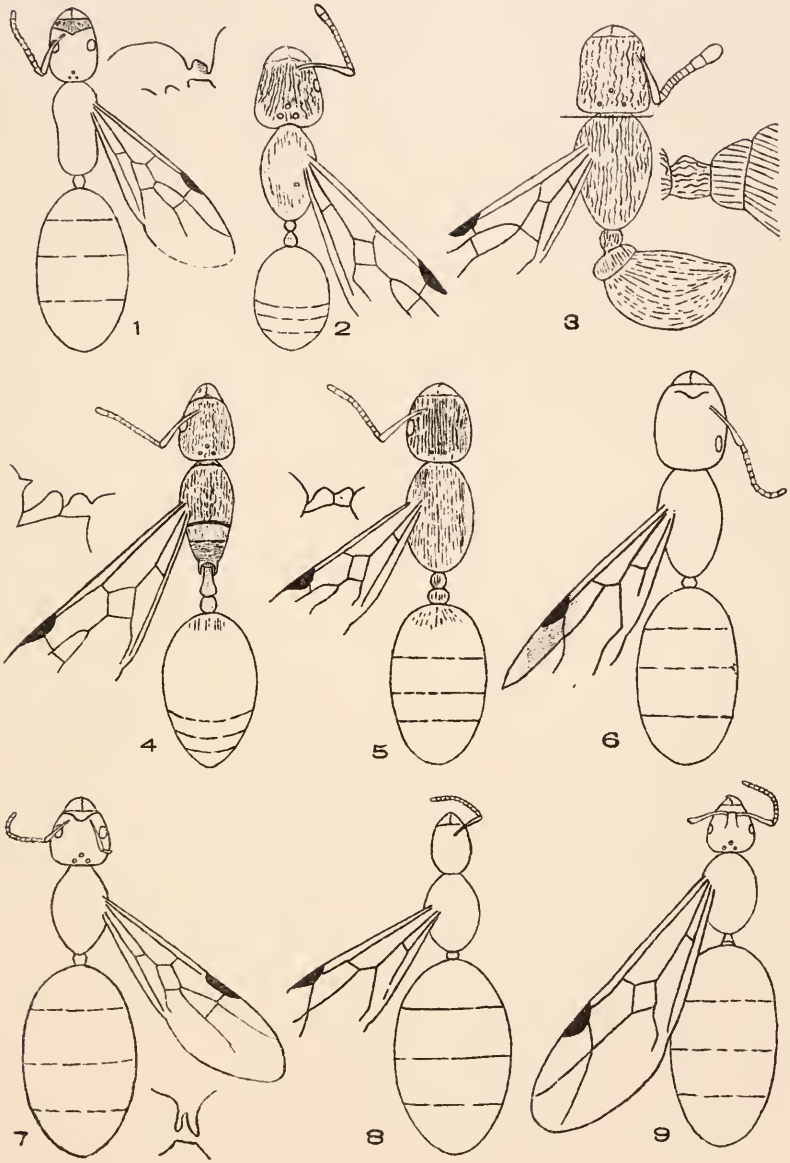
PLATE 11

PLATE 11

Fig. 1. *Elaeomyrmex gracilis*, sp. nov. ♀.
Fig. 2. *Pheidole tertiaria*, sp. nov. ♀.
Fig. 3. *Lithomyrmex rugosus*, sp. nov. ♀.
Fig. 4. *Aphaenogaster mayri*, sp. nov. ♀.
Fig. 5. *Messor sculpturatus*, sp. nov. ♀.
Fig. 6. *Camponotus fuscipennis*, sp. nov. ♀.
Fig. 7. *Liometopum miocenicum*, sp. nov. ♀.
Fig. 8. *Camponotus microcephalus*, sp. nov. ♀.
Fig. 9. *Lasius peritulus* (Ckll.). ♀.



HELIOTYPE CO. BOSTON

EXPLANATION OF PLATES

PLATE 1

PLATE 1

Fig. 1. The Permian insect locality, Elmo, Kansas. August, 1927.

Fig. 2. One of the Harvard quarries of 1927. The insect bed is exposed as an irregular layer of limestone blocks. The floor of the quarry is the top of the "stump bed," and the stratum above the insect layer is the upper, unfossiliferous part of the Elmo limestone.

Fig. 3. Another one of the Harvard quarries, showing the shaly aspect of the Elmo limestone.

Fig. 4. Stump of the tree-fern *Psaronius* at the Elmo deposit. These stumps are common in the carbonaceous plant layer below the insect bed and form excellent landmarks to the locality.

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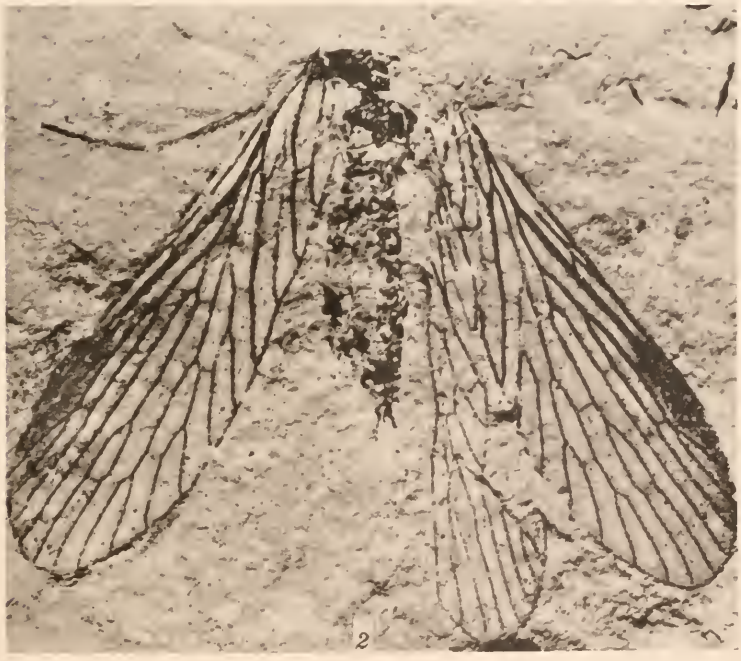
HELIOTYPE CO. BOSTON

PLATE 2

PLATE 2

Fig. 1. Photograph of wing of *Agetopanorpa maculata*, new species. No. 3037a, M. C. Z. (× 10).

Fig. 2. Photograph of *Permopanorpa inaequalis* Till., female. No. 3022a, M. C. Z. (× 16).



HELIOTYPE CO. BOSTON

PLATE 3

PLATE 3

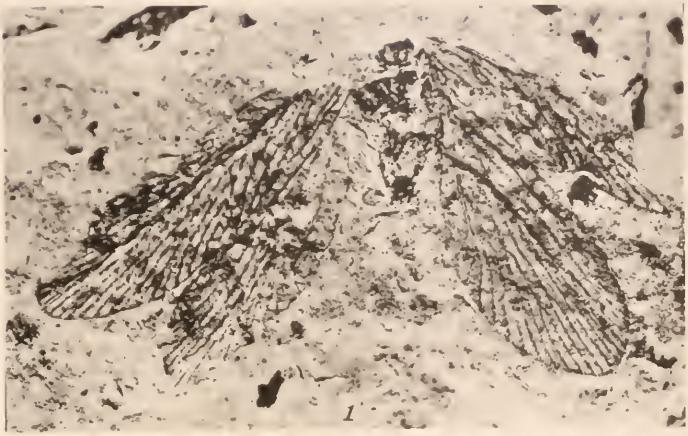
Fig. 1. Photograph of *Platychorista venosa* Till., male. No. 3007a, M. C. Z. (× 10).

Fig. 2. Photograph of hind wing of *Permopanorpa inaequalis* Till. No. 3017, M. C. Z. (× 10).

Fig. 3. Photograph of fore wing of *Protopanorpa permiana* Till. No. 3034a, M. C. Z. (× 10).

Fig. 4. Photograph of wing of *Lithopanorpa pusilla* (Till.). No. 5066a, Peabody Museum. (× 20).

Fig. 5. Photograph of fore wing of *Permopanorpa inaequalis* Till. No. 5059, Peabody Museum (holotype of *P. tenuis* Till.) (× 19).



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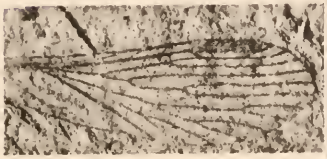

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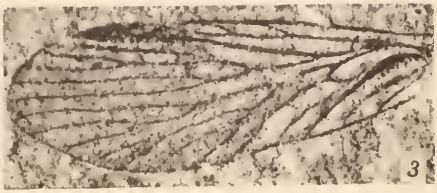

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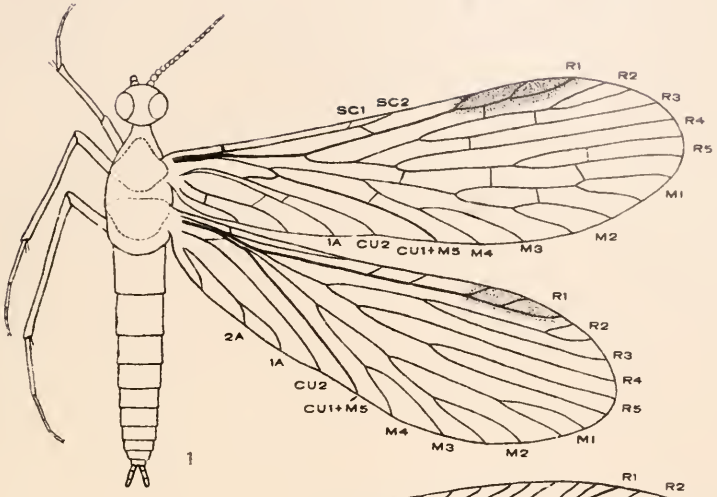
HELIOTYPE CO. BOSTON

PLATE 4

PLATE 4

Fig. 1. *Permopanorpa inaequalis* Till., female.
Fig. 2. *Platychorista venosa* Till., female.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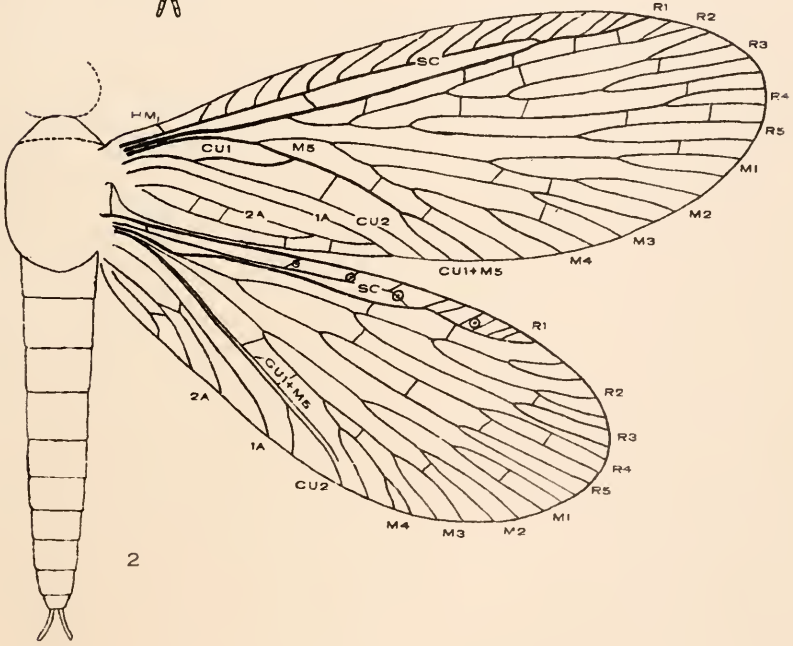
R2
R3
R4
R5
M1
M2
M3
M4
SC1
SC2
1A
CU2
CU1+M5
2A

1

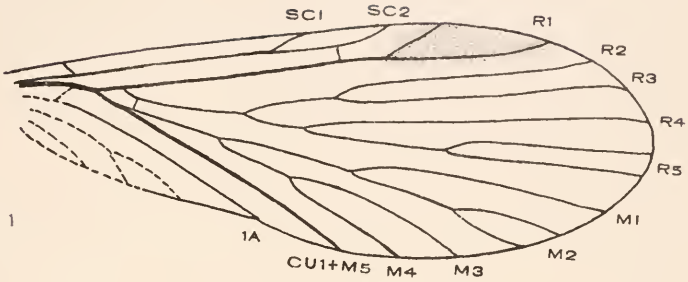

R1
R2
R3
R4
R5
M1
M2
M3
M4
SC
CU1
M5
1A
CU2
CU1+M5
2A

2

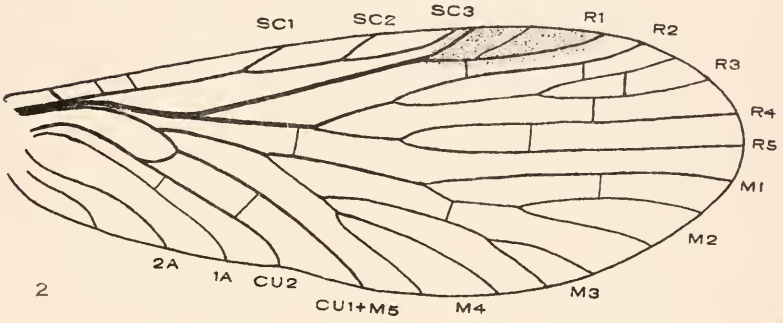
PLATE 5

PLATE 5

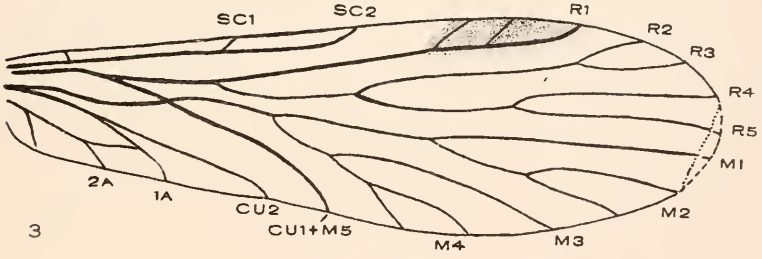
Fig. 1. Hind wing of *Protochorista tetraclada* Till.
Fig. 2. Fore wing of *Protopanorpa permiana* Till.
Fig. 3. Wing of *Lithopanorpa pusilla* (Till).
Fig. 4. Wing of *Agetopanorpa maculata*, new species.


SC1
SC2
R1
R2
R3
R4
R5
M1
M2
M3
M4
CU1+M5
1A

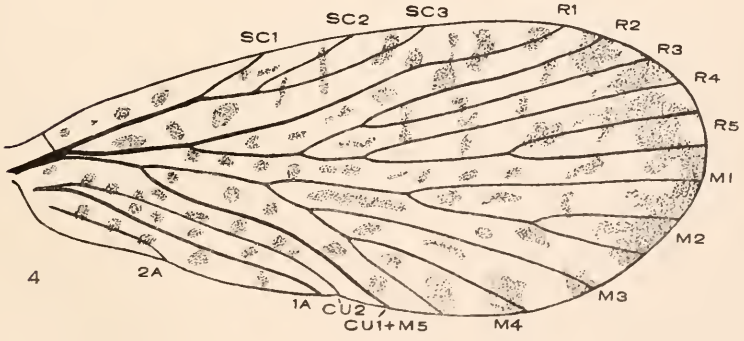
1


SC1
SC2
SC3
R1
R2
R3
R4
R5
M1
M2
M3
M4
CU1+M5
CU2
1A
2A

2


SC1
SC2
R1
R2
R3
R4
R5
M1
M2
M3
M4
CU1+M5
CU2
1A
2A

3


SC1
SC2
SC3
R1
R2
R3
R4
R5
M1
M2
M3
M4
CU1+M5
CU2
1A
2A

4

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